OIL AND GAS CONSERVATION BOARD

Application by
Alberta and Southern Gas Co. Ltd.
for a permit authorizing the removal
of gas from the Province of Alberta

VOLUME II

Pipeline Engineering and Capital Costs

1957

cage

Energy 1958

Exhibit no. C-17
vol. 2

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Hearing No. .....

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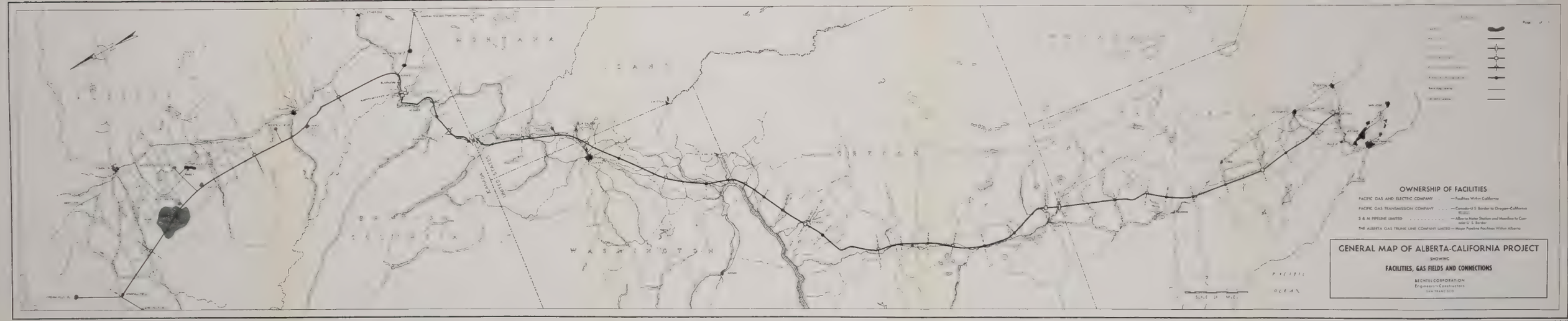
GENERAL MAP OF PROPOSED SYSTEM

ALBERTA AND SOUTHERN GAS CO. LTD.


ALBERTA
MONTANA
IDAHO
OREGON
CALIFORNIA
WASHINGTON
PACIFIC OCEAN
SAN JOSE
OWNERSHIP OF FACILITIES
PACIFIC GAS AND ELECTRIC COMPANY — Facilities Within California
PACIFIC GAS TRANSMISSION COMPANY — Canada-U.S. Border to Oregon-California Border
S & M PIPELINE LIMITED — Alberta Hanlan Station and Haseline to Canada-U.S. Border
THE ALBERTA GAS TRUNK LINE COMPANY LIMITED — Major Pipeline Facilities Within Alberta
GENERAL MAP OF ALBERTA-CALIFORNIA PROJECT
SHOWING
FACILITIES, GAS FIELDS AND CONNECTIONS
BECHTEL CORPORATION
Engineers—Constructors
SAN FRANCISCO

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

KEY CHART AND INDIVIDUAL MAPS OF CONSTRUCTION SECTIONS

ALBERTA AND SOUTHERN GAS CO. LTD.

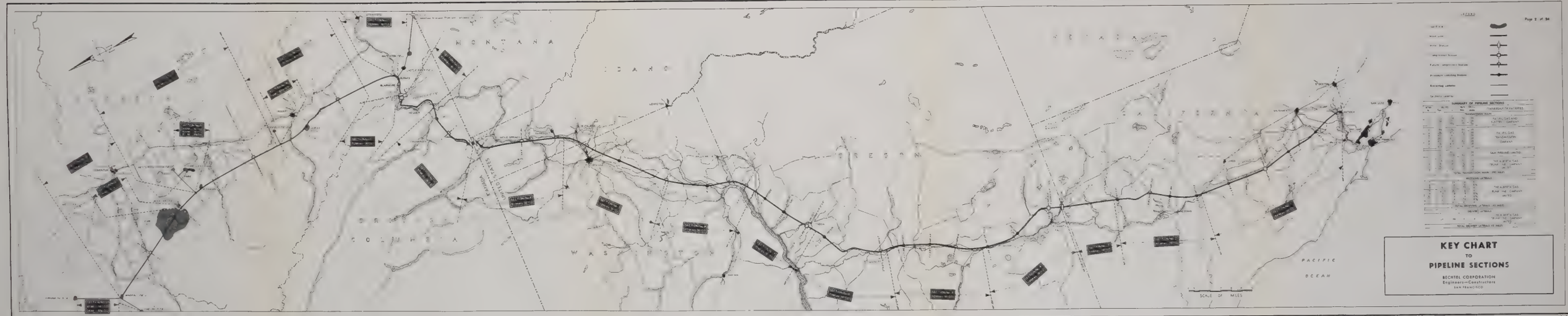
KEY CHART AND INDIVIDUAL MAPS OF CONSTRUCTION SECTIONS

The Key Chart shows how pipeline construction has been divided to insure completion of the line in two construction seasons, using a minimum of crews. There are sixteen mainline sections, each a reasonable season's work for one pipeline spread, allowing for construction difficulties and length of the construction season in the particular area. Mainline section lengths were adjusted so they would not overlap operating company ownership boundaries.

Sections are numbered consecutively from south to north.

The construction sections for the laterals are separated by the fields served.

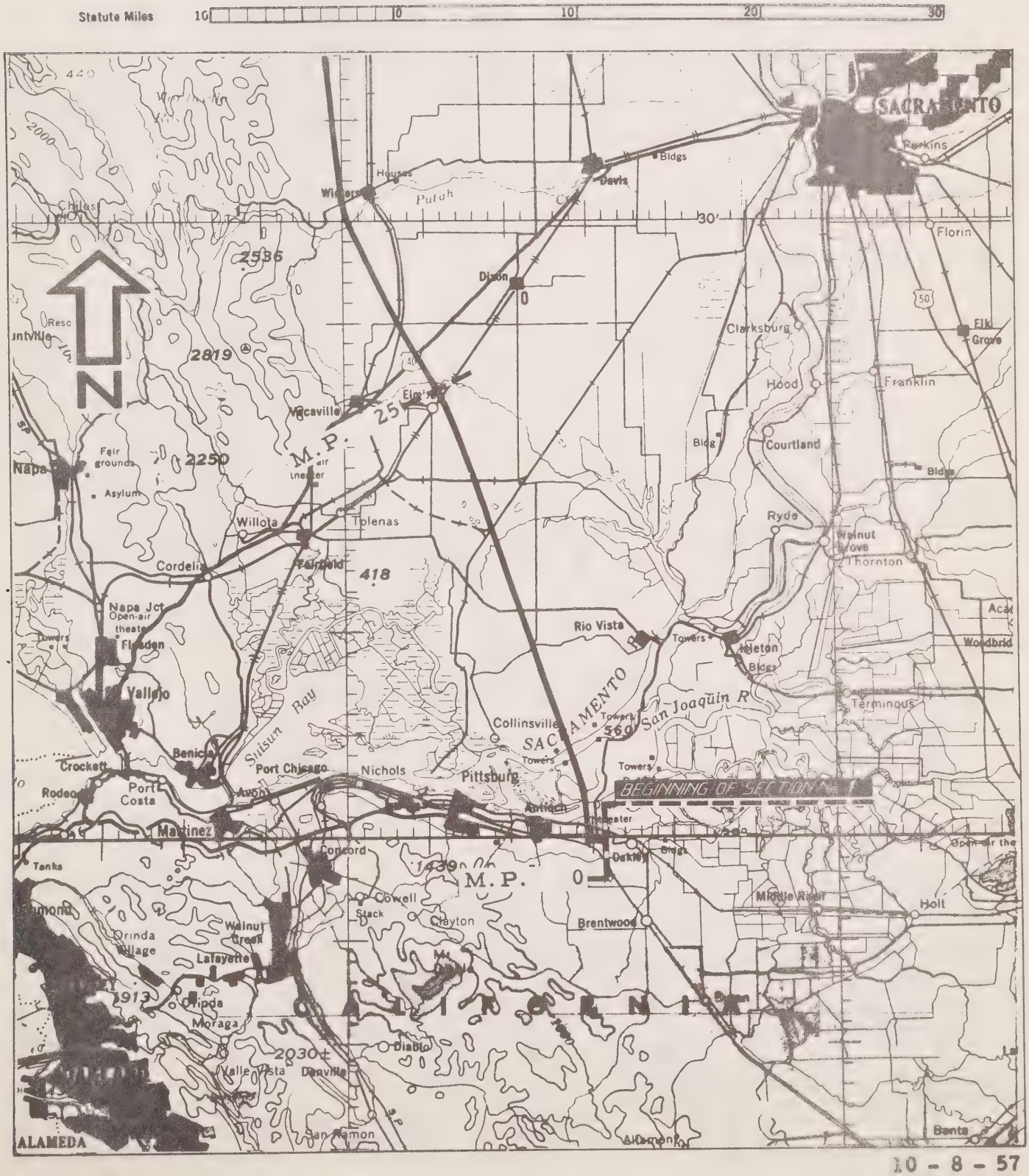
Pipeline section charts are on a scale of eight miles to the inch, to show the topography and location of the proposed route in more detail than does the general map of the system.


MONTANA
IDAHO
OREGON
NEVADA
UTAH
WASHINGTON
PACIFIC
OCEAN
SCALE OF MILES
KEY CHART
TO
PIPELINE SECTIONS
BECHTEL CORPORATION
Engineers—Constructors
SAN FRANCISCO

Pacific Gas and Electric Company

PIPELINE SECTION CHART

Section 1 - 156 Miles

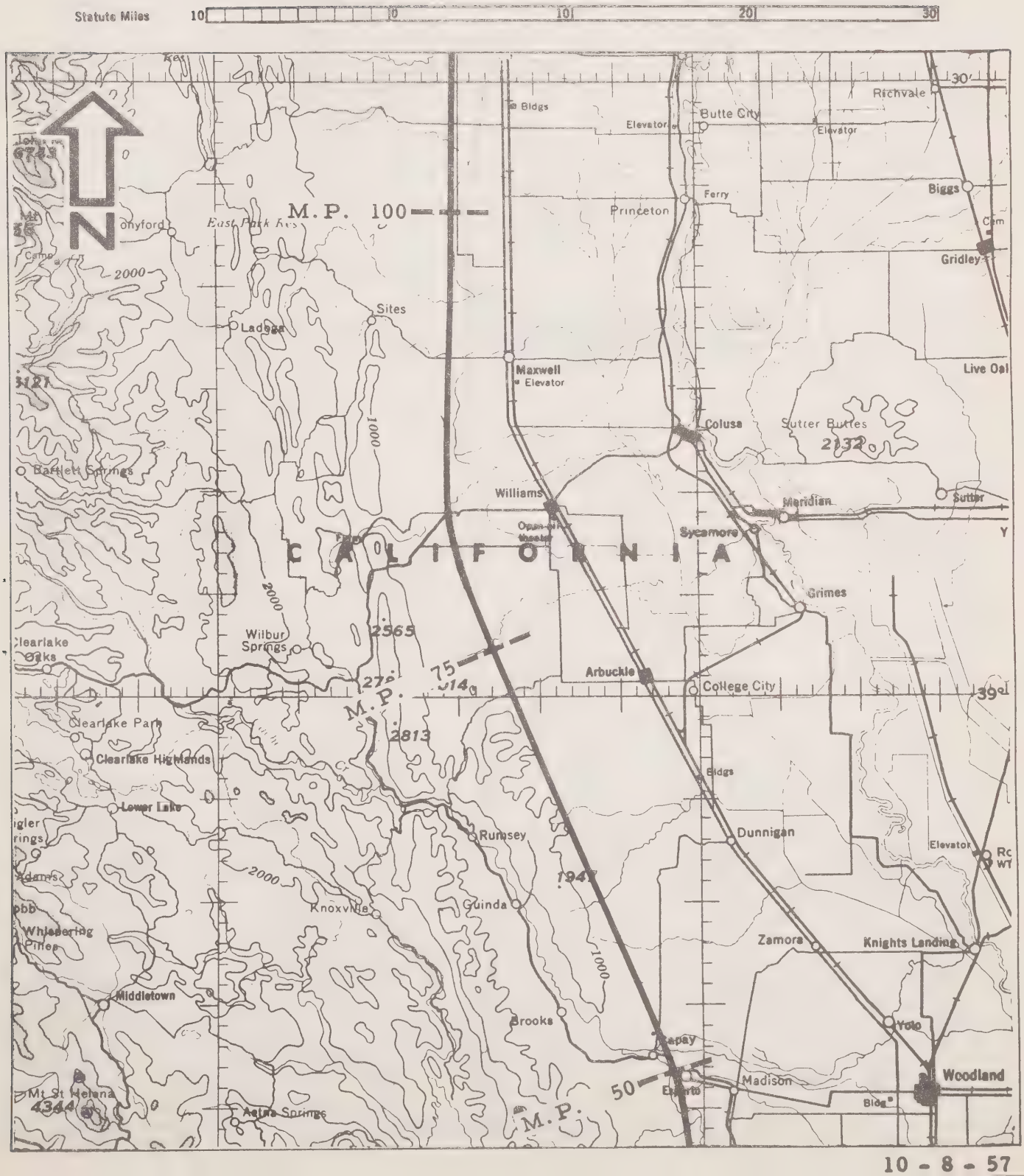


10 - 8 - 57

Pacific Gas and Electric Company

PIPELINE SECTION CHART

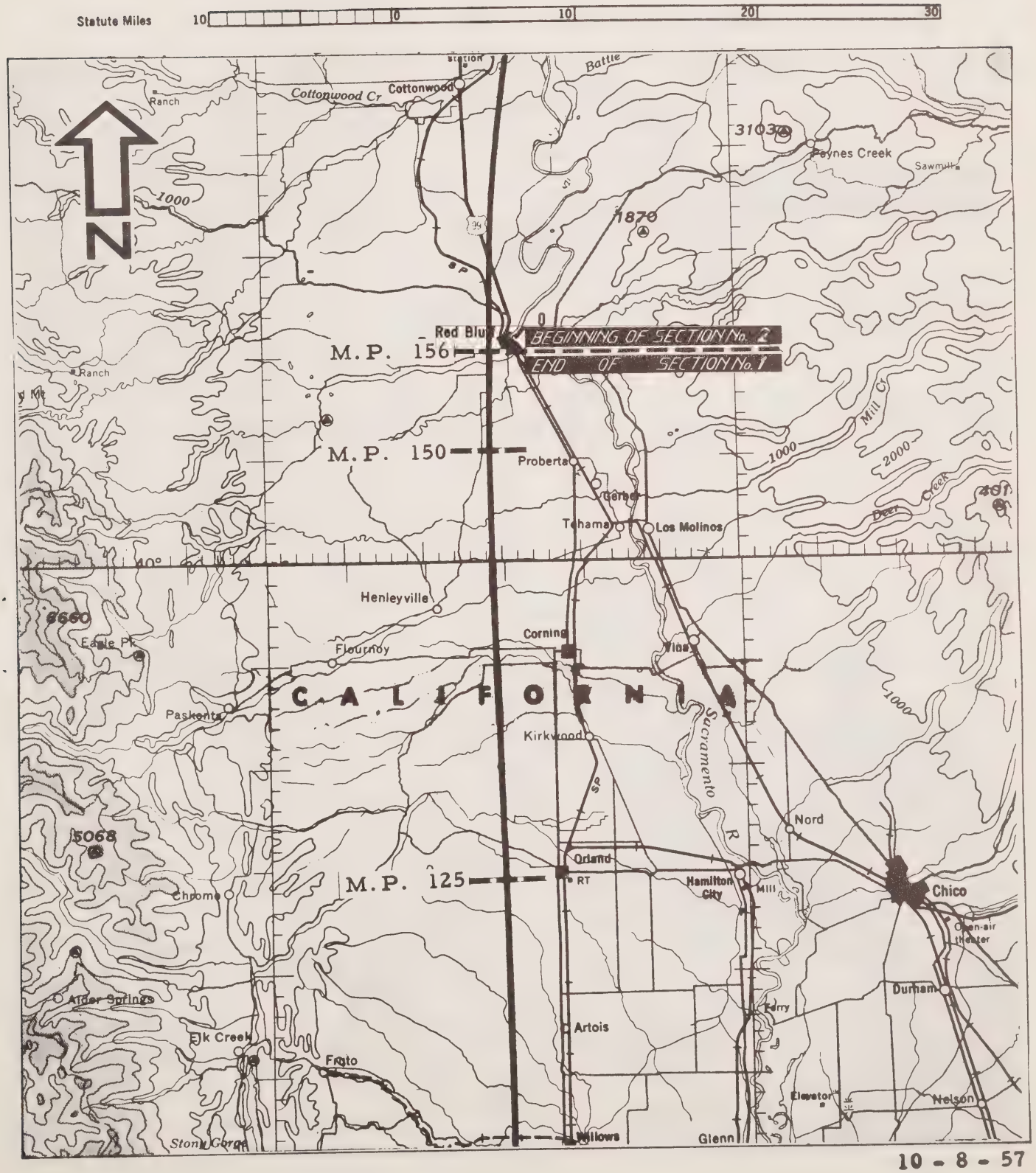
Section 1 - Continued



Pacific Gas and Electric Company

PIPELINE SECTION CHART

Section 1 - Continued
Section 2 - 81 Miles



Pacific Gas and Electric Company

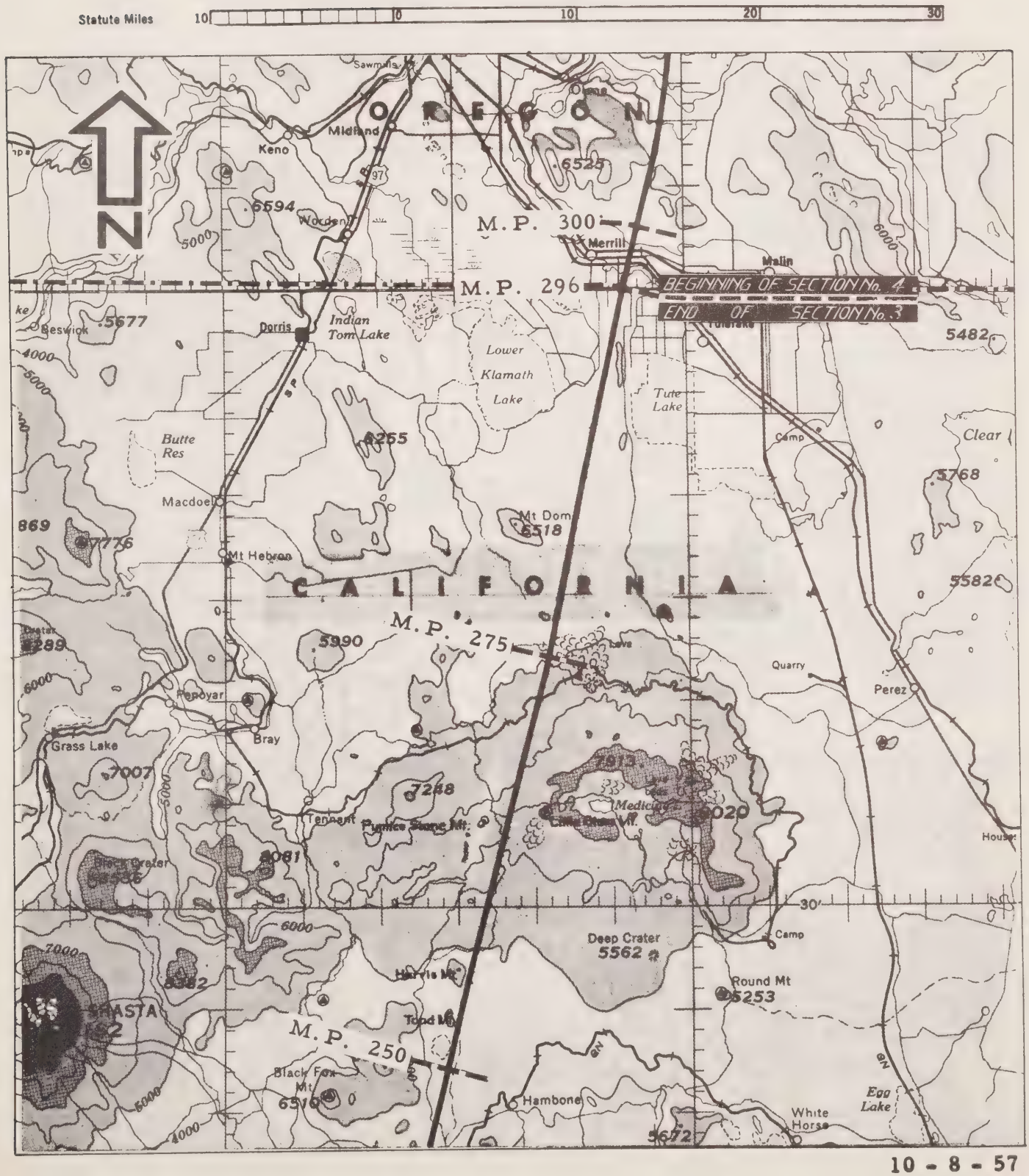
PIPELINE SECTION CHART

Section 2 - Continued
Section 3 - 59 Miles

Pacific Gas and Electric Company (Section 3)
Pacific Gas Transmission Company (Section 4)

PIPELINE SECTION CHART

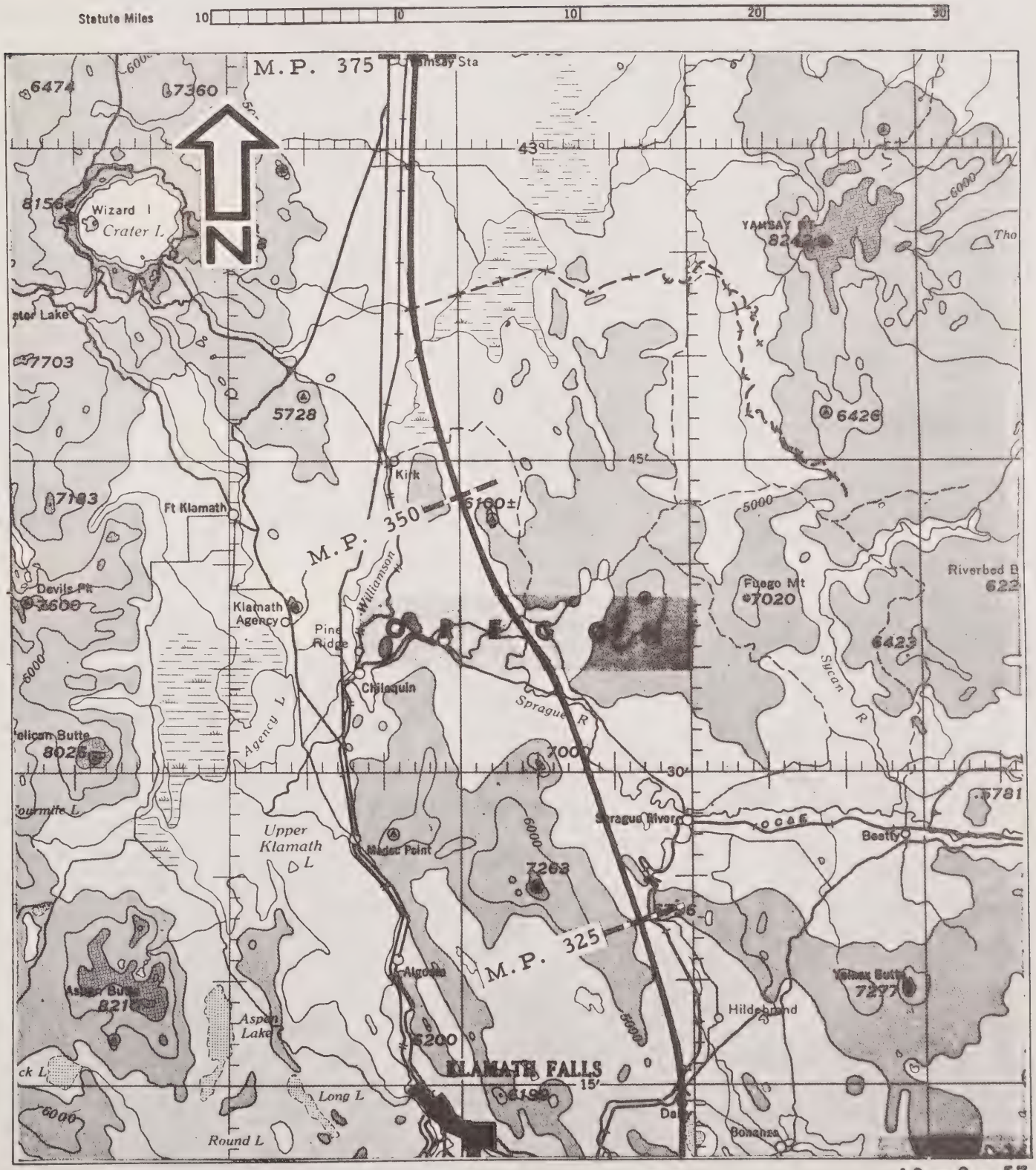
Section 3 - Continued
Section 4 - 84 Miles



Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 4 - Continued



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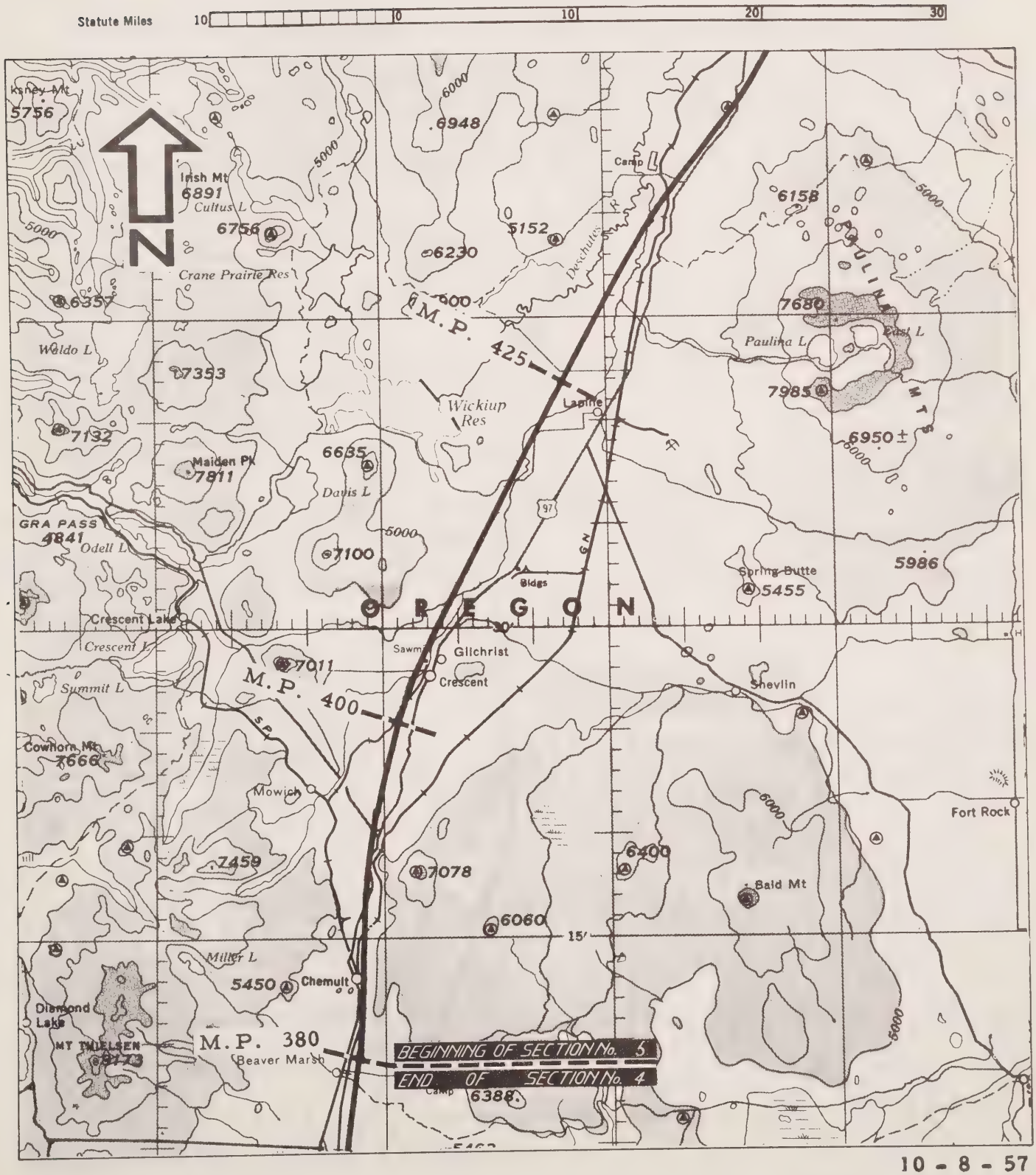
Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 4 - Continued
Section 5 - 92 Miles



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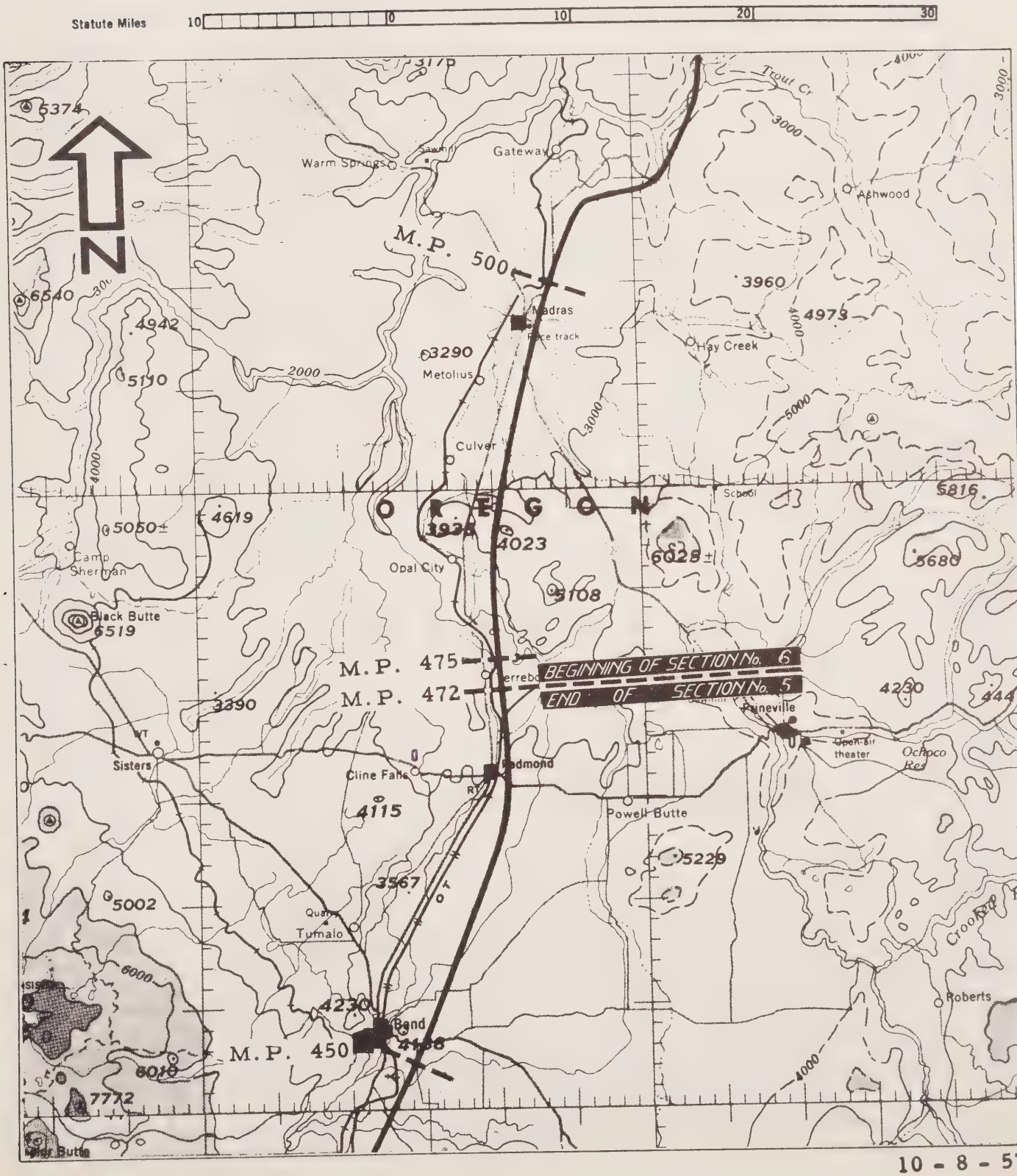
Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 5 - Continued
Section 6 - 73 Miles



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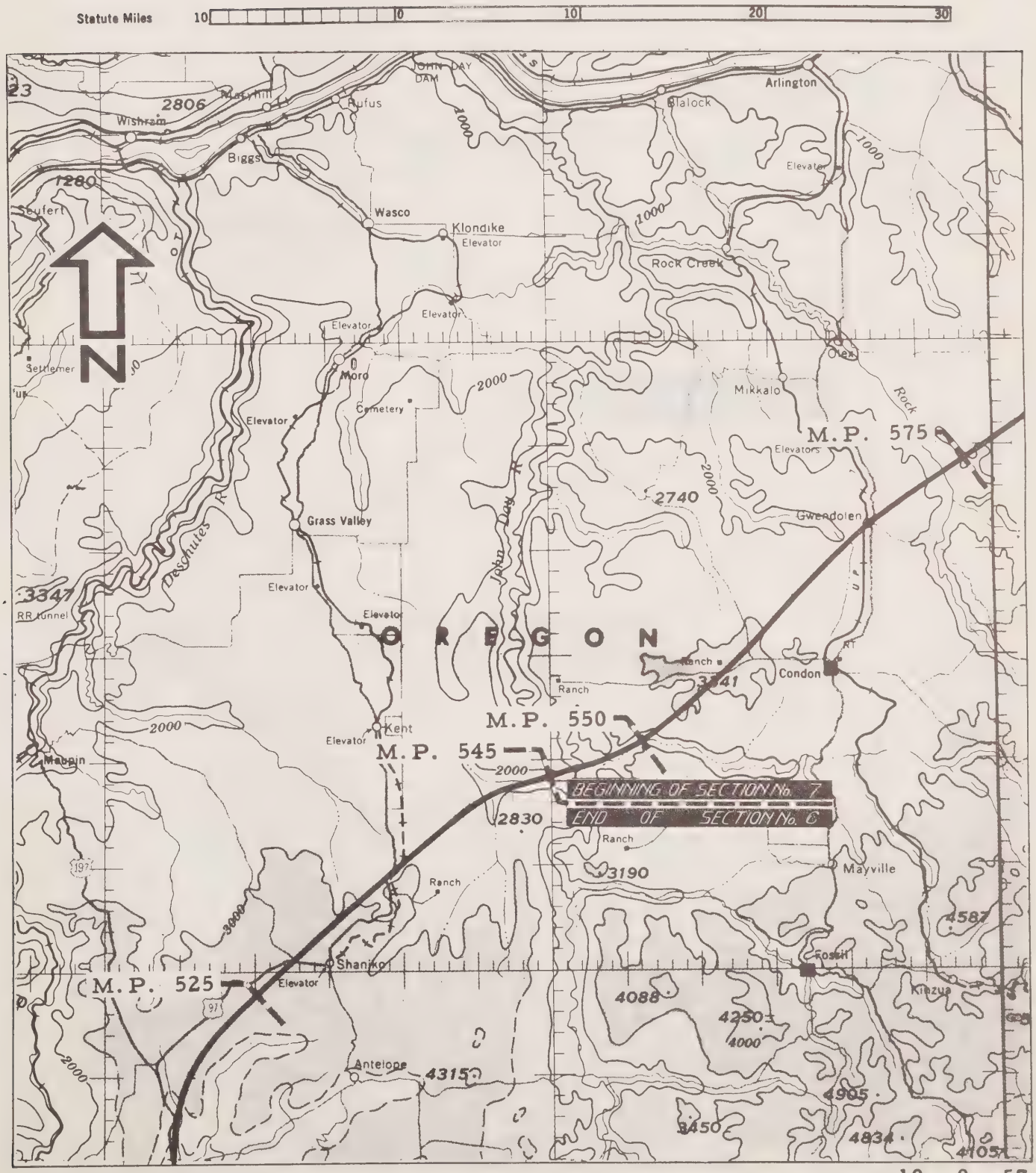
Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 6 - Continued
Section 7 - 70 Miles



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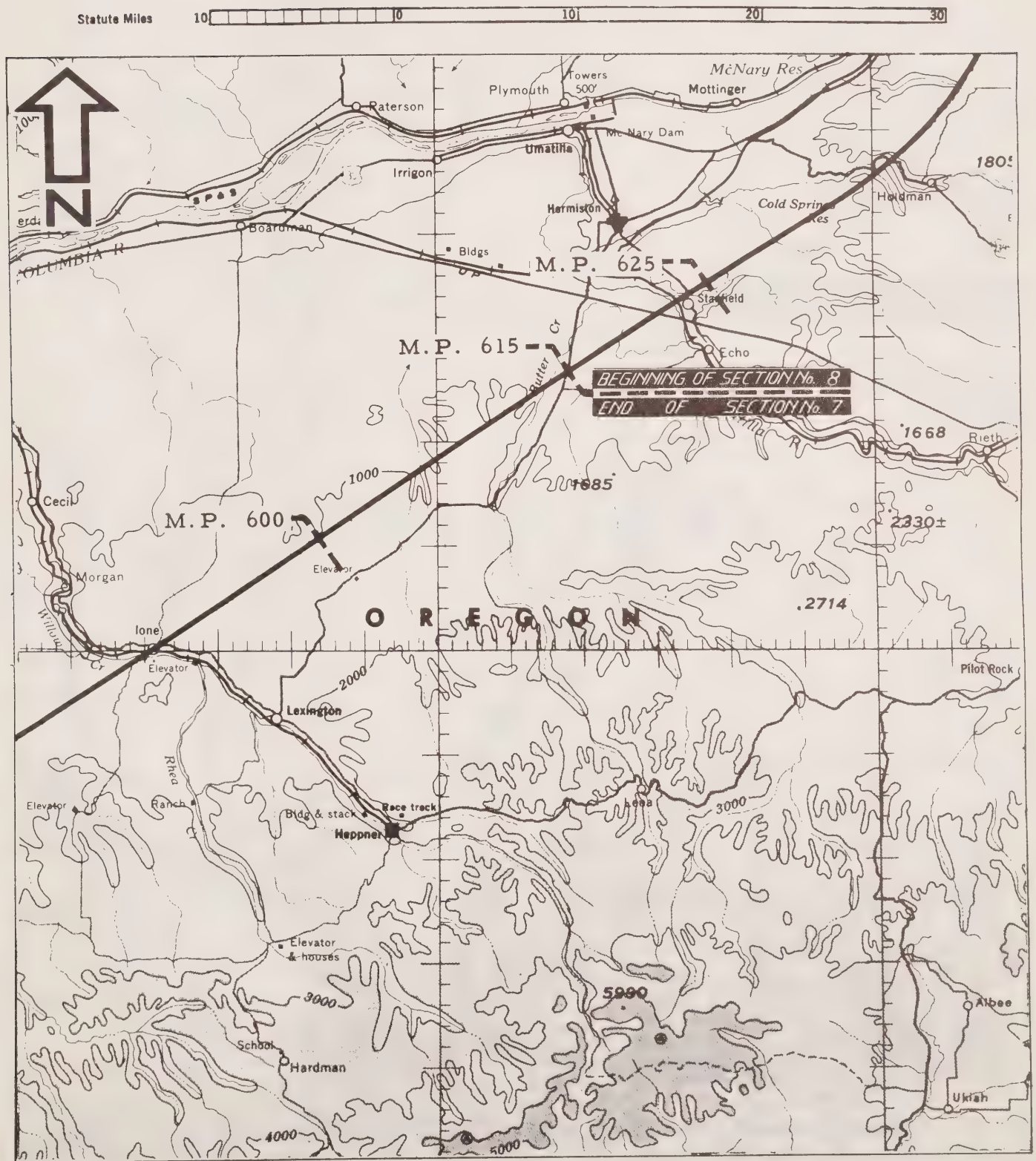
Pacific Gas Transmission Company

PIPELINE SECTION CHART

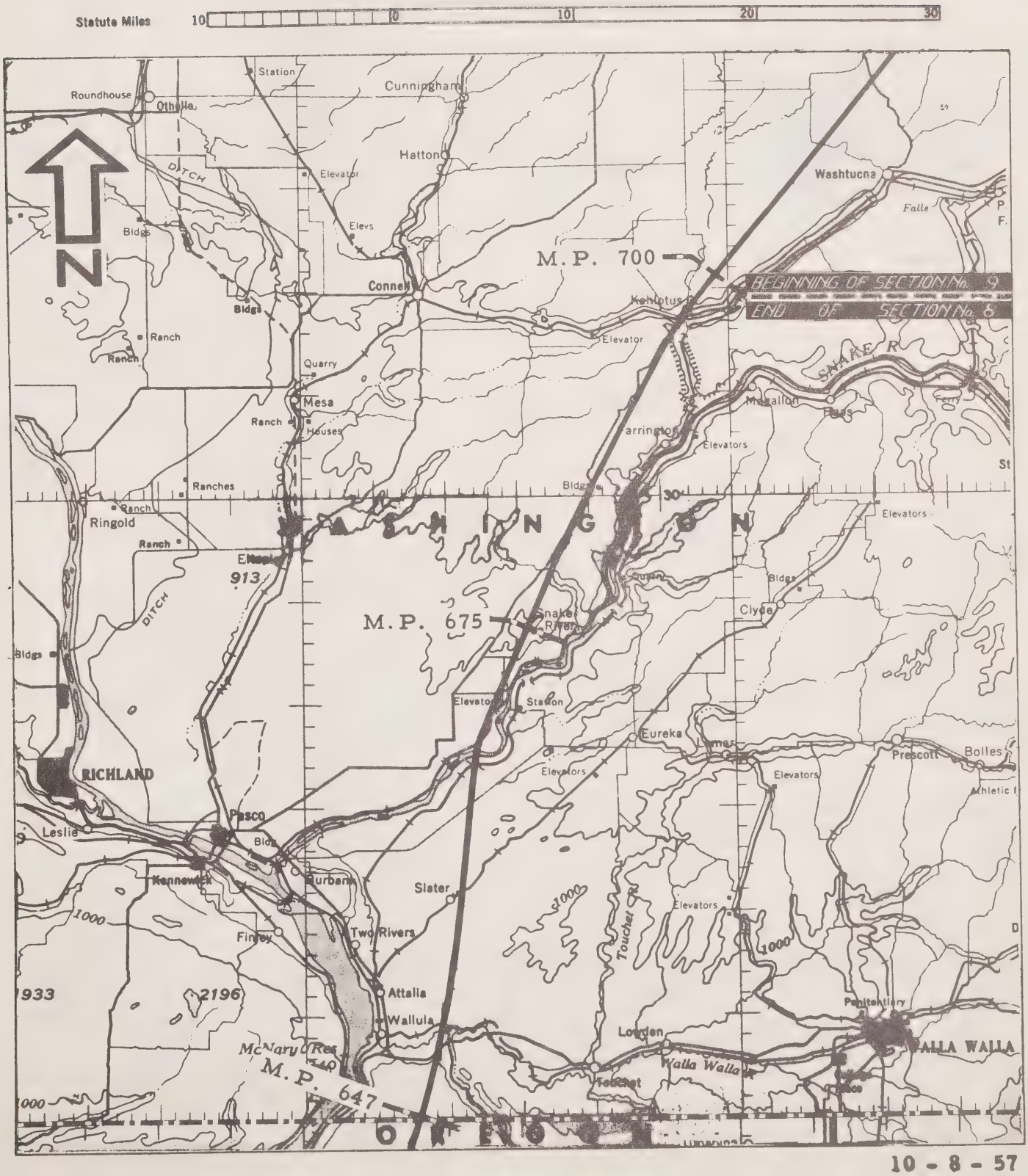
Section 7 - Continued
Section 8 - 85 Miles



Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 8 - Continued
Section 9 - 119 Miles



10 - 8 - 57

Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 9 - Continued

Pacific Gas Transmission Company

PIPELINE SECTION CHART

Section 9 - Continued
Section 10- 91 Miles

Pacific Gas Transmission Company (Section 10)
S & M Pipeline Limited (Section 11)

PIPELINE SECTION CHART

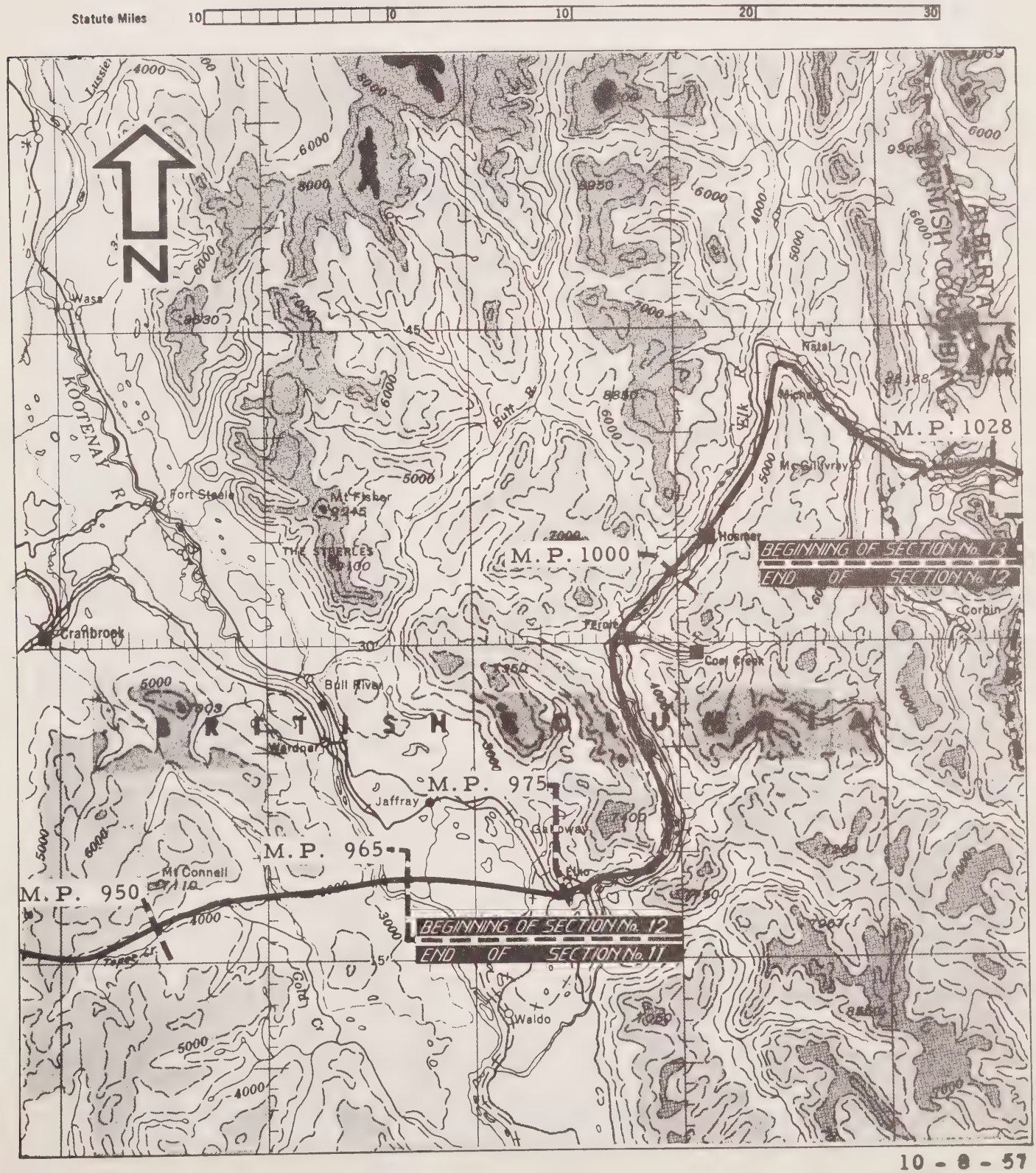
Section 10 - Continued
Section 11 - 55 Miles

10 - 8 - 57

S & M Pipeline Limited

PIPELINE SECTION CHART

Section 11 - Continued
Section 12 - 63 Miles

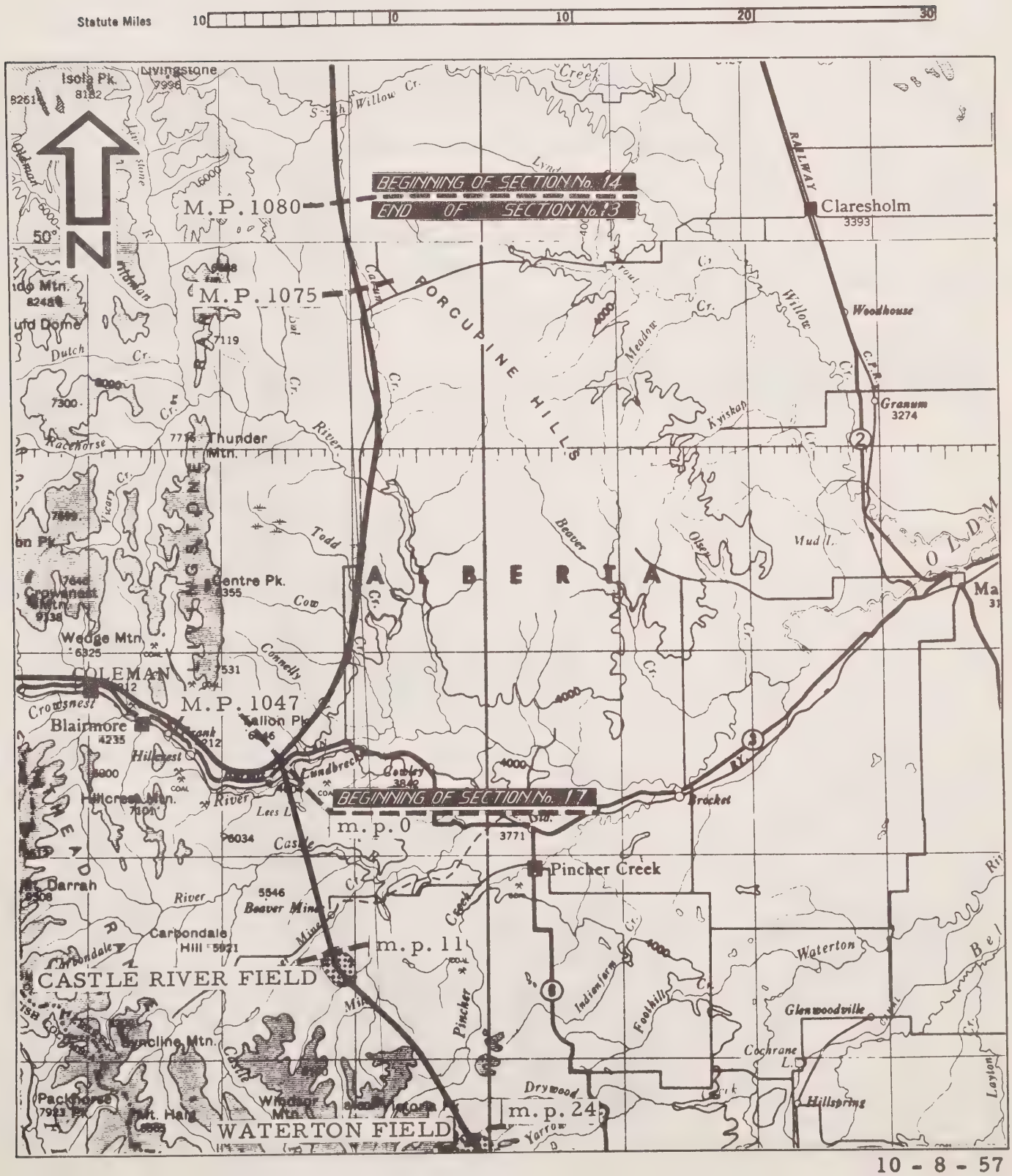


10 - 8 - 57

The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

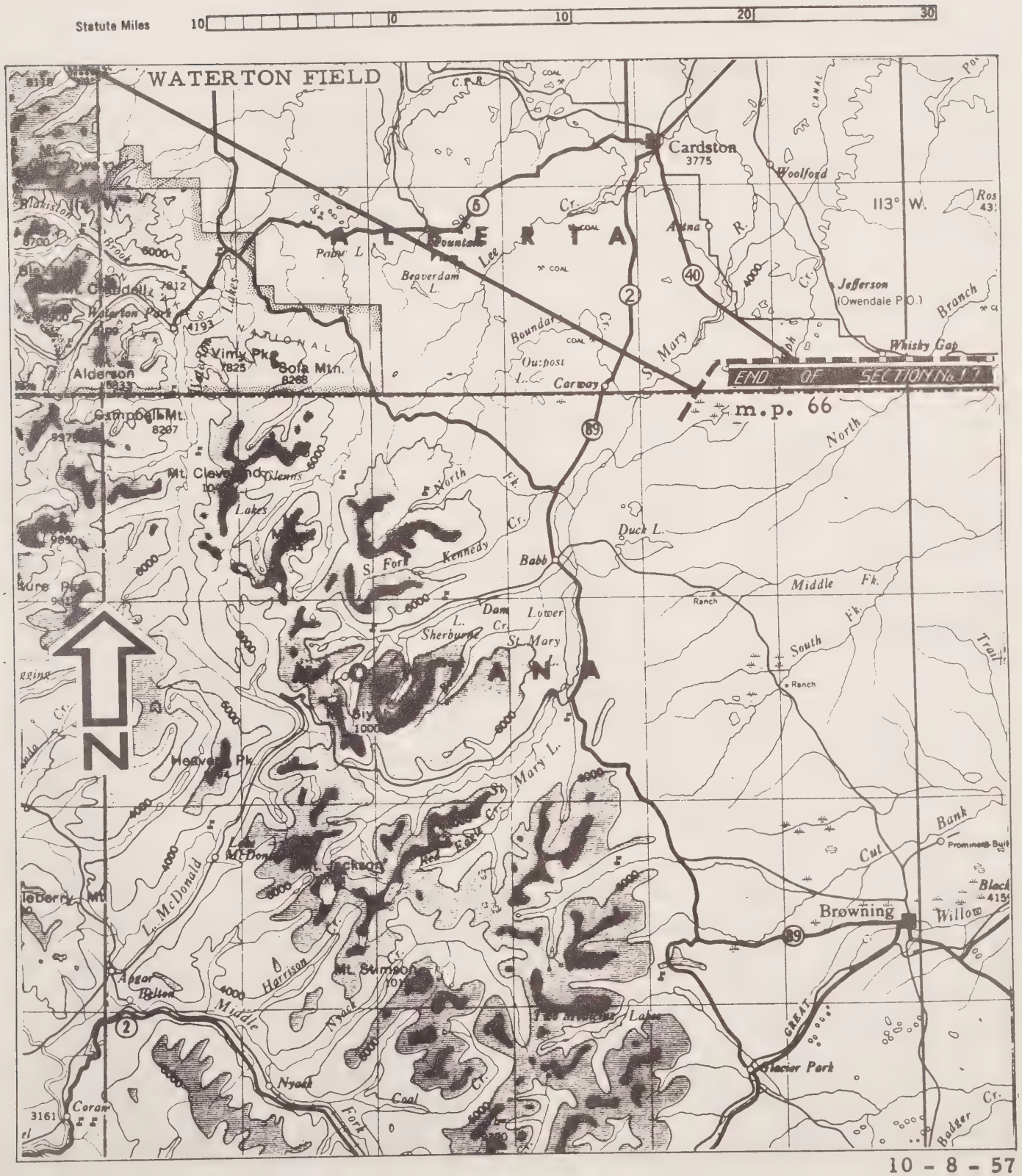
Section 13 - 52 Miles
Section 14 - 100 Miles
Section 17 - 66 Miles



The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

Section 17 - Continued



The Alberta Gas Trunk Line Company Limited

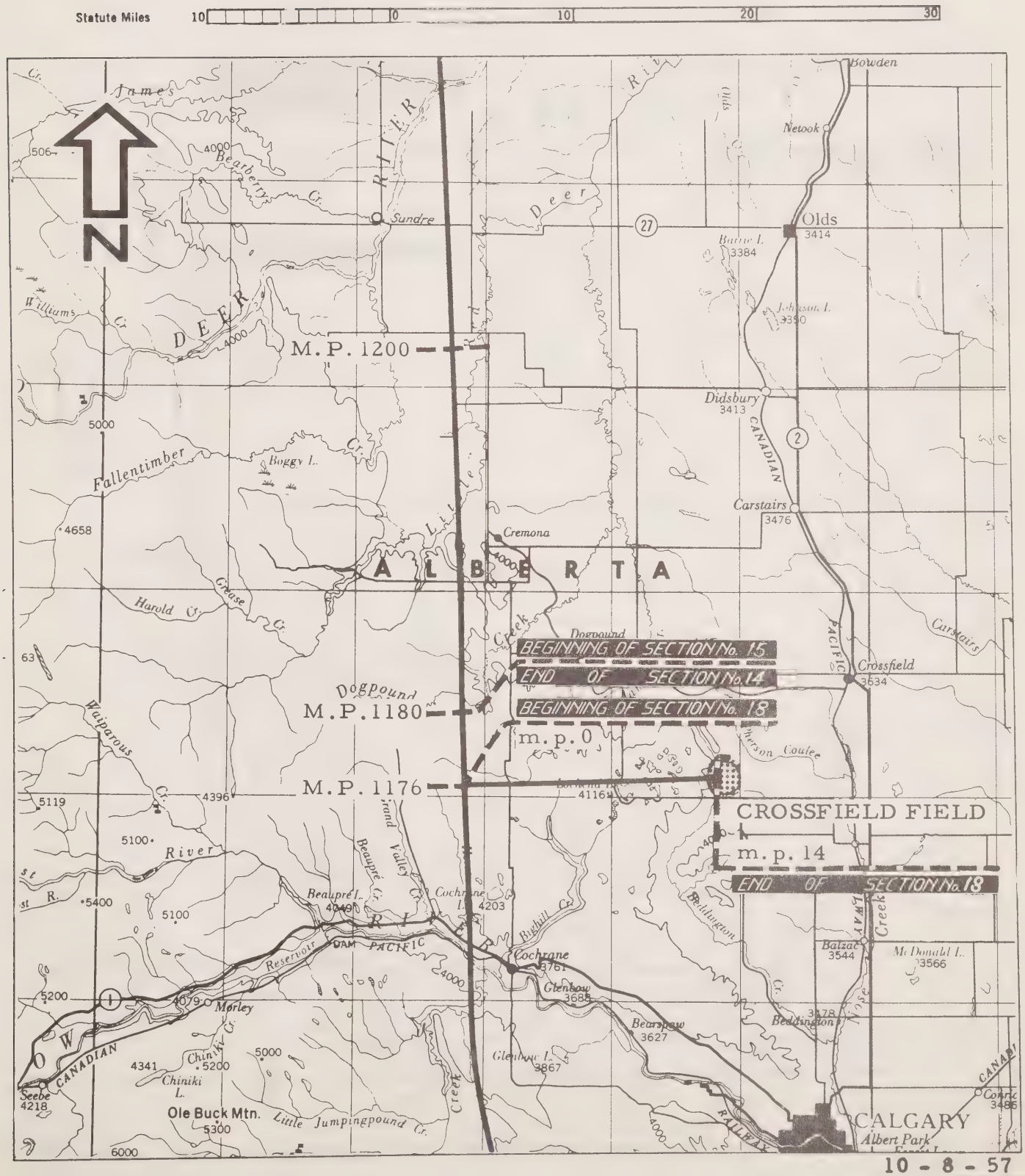
PIPELINE SECTION CHART

Section 14 - Continued

The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

Section 14 - Continued
Section 15 - 90 Miles
Section 18 - 14 Miles



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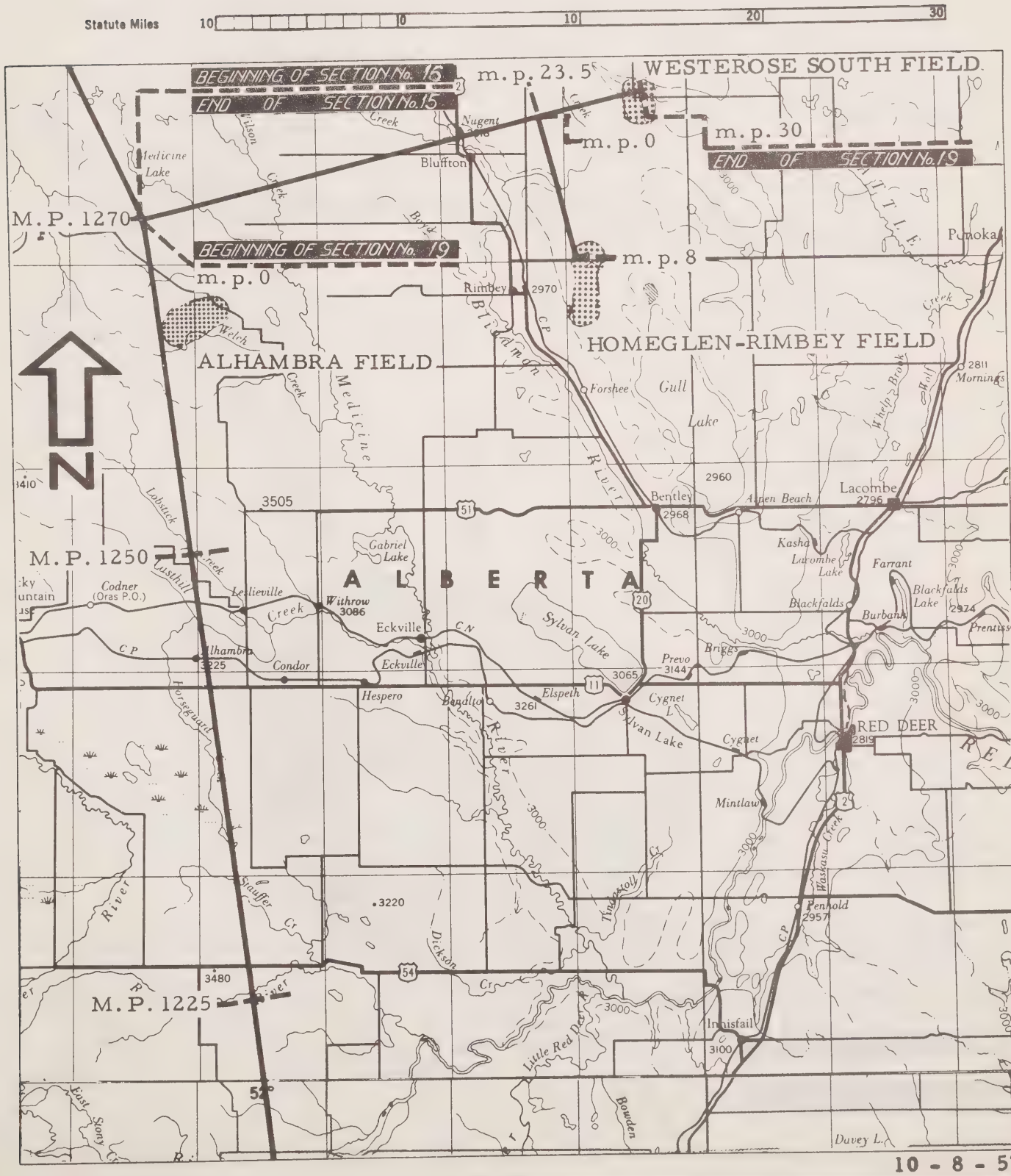
The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

Section 15 - Continued
Section 16 - 120 Miles
Section 19 - 38 Miles

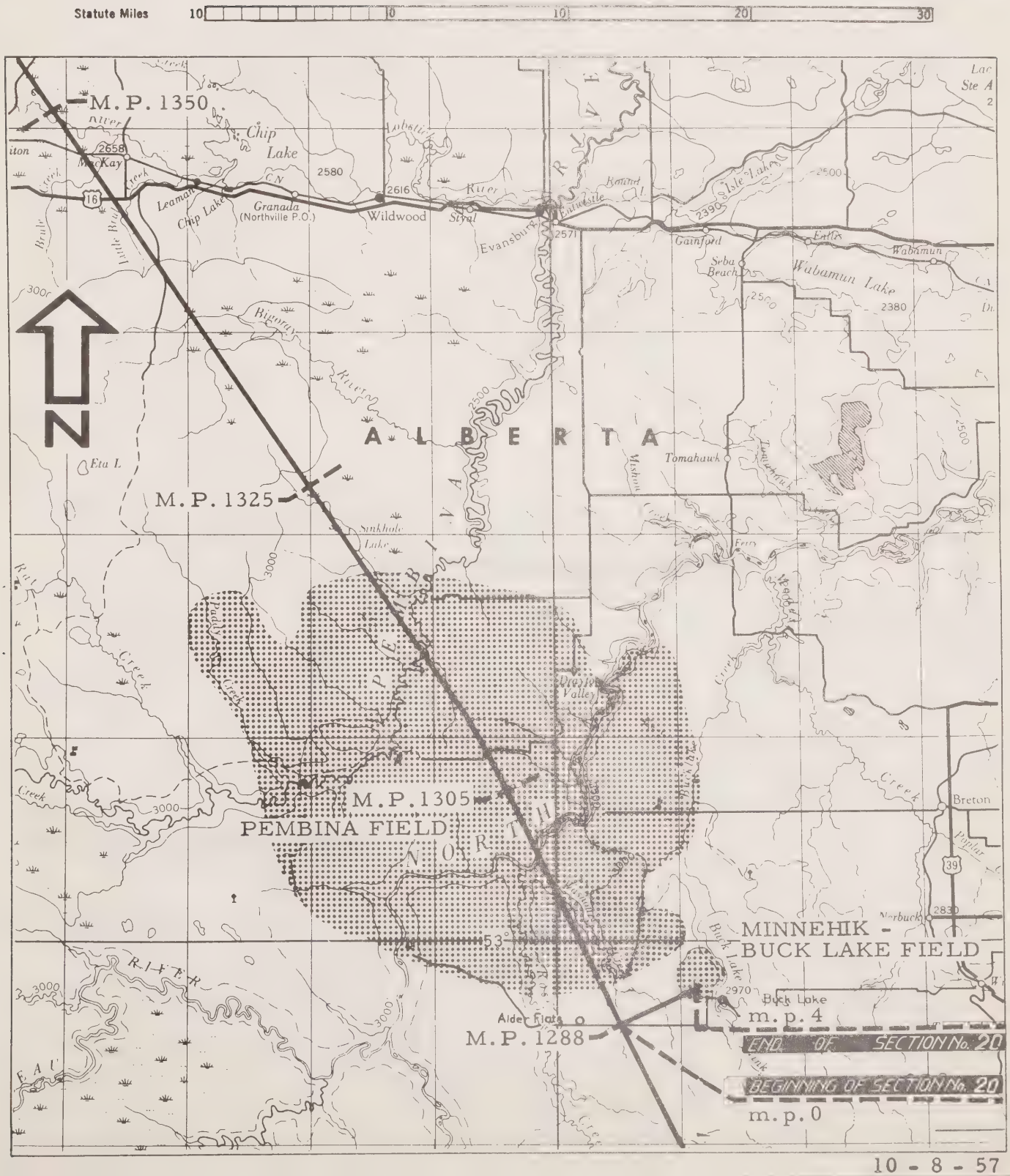


10 - 8 - 57

The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

Section 16 - Continued
Section 20 - 4 Miles



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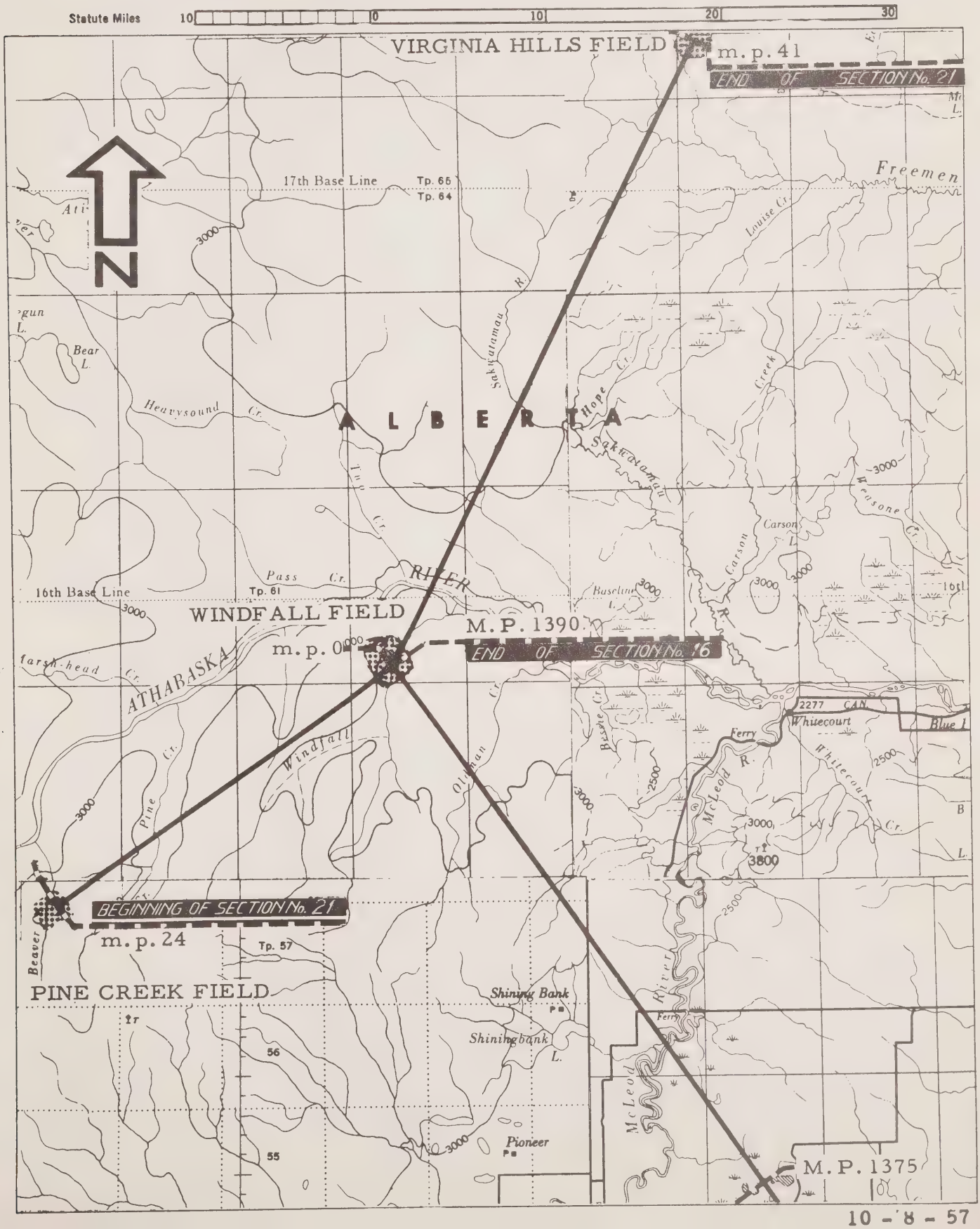
The Alberta Gas Trunk Line Company Limited

PIPELINE SECTION CHART

Section 16 - Continued Section 21 - 65 Miles



Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

DESCRIPTION OF LOCATION OF EACH CONSTRUCTION SECTION

ALBERTA AND SOUTHERN GAS CO. LTD.

DESCRIPTION OF ROUTE

The following pages present a brief description of the proposed pipeline route, based on actual field reconnaissance. The general location, type of terrain, soil conditions and ground cover are touched on, and special mention is made of any unusual construction problems to be met.

Each construction section shown on the "Key Chart" and accompanying maps is taken up separately.

Section numbering is from south to north. The lateral lines, Sections numbered 17 to 21, provide connections from the gas fields to the main trunk line, and in one instance to the Canadian Montana Pipeline Company.

A pipeline of this length - running generally north and south - naturally passes through a wide range of climatic conditions. These must be taken into account. Information about the weather likely to be met along the line is therefore included with the physical route description. Weather data for points along the route are tabulated on Page 14 of this exhibit.

DESCRIPTION OF ROUTE

Section No. 1 - 156 Miles

Section No. 1 is the longest and easiest construction section in the entire system. It begins at the southern terminal of the mainline on the south side of the San Joaquin River, approximately four miles east of Antioch, California. Crossing the San Joaquin River where it narrows to 3700 feet, just west of the bridge on Highway 24, the route then proceeds across Sherman Island. Sherman Island is ringed by a 20-foot high earth dike which protects the intensely cultivated low land from river flood waters. The Sacramento River north of Sherman Island is 2700 feet wide at the point of crossing.

Beyond the Sacramento River, the line runs northwest across rolling open country to Elmira. The land is cultivated and quite flat from Elmira past Winters and north to Esparto. The next 20 miles of route cuts to the northwest across rolling foothills that are partially covered with spruce trees up to 12 inches in diameter. Near Williams the line again turns and runs north to the end of Section No. 1 at Red Bluff, California. The last 80 miles in the section traverses open, slightly rolling country, presently cultivated or used for grazing.

Throughout the section, the route generally parallels a main power transmission right-of-way. Soil conditions along the route are for the most part good with no rock evident. But there are some sections where the ground is soft and wet, notably across Sherman Island and through the rice fields in the vicinity of Williams. Right-of-way clearing through timber and orchards will be required for a total distance of 13 miles.

In addition to the two river crossings at the southern end of the section, there will be approximately 90 small creek crossings and 16 larger stream crossings. There are 40 main highway crossings and four railroad crossings in this section.

Section No. 2 - 81 Miles

From the beginning of Section No. 2 at Red Bluff, the pipeline route continues northward through rolling, wooded country to a crossing of the Sacramento River, four miles east of Anderson. The river is about 900 feet wide at this point. Here the route bears northeast for 30 miles to the vicinity of Round Mountain. The generally flat terrain on this course is broken, as the line dips sharply into four creek bottoms. Boulders and rock outcroppings are scattered through the area.

At Round Mountain the route swings to the north leaving the power transmission right-of-way that was more or less paralleled for the preceding 200 miles. The surface of the ground becomes increasingly choppy over the next 15 miles, then drops sharply to the Pit River at Big Bend. North of the crossing, the route rises on a fairly uniform slope to an elevation of 4300 feet just east of Bald Mountain. There is quite dense forest cover in this area. The line drops sharply to 3000 feet in the next mile, then climbs to an elevation of 5,500 feet during the following 3 miles, to pass just east of Mushroom Rock. The section ends 5 miles south of Bartle, California.

An estimated total of 18 miles of solid rock and 29 miles of boulders and loose rock will be met in excavating the pipeline trench through this section. The route has timber cover on 53 miles.

In addition to the two river crossings, there are 25 creek crossings, one railroad crossing and 13 highway crossings in this 81-mile section.

Section No. 3 - 59 Miles

Section No. 3 begins five miles south of Bartle, descending a thousand feet in three miles, over rough, rocky, heavily wooded terrain. The next 17 miles are relatively flat, but climb gradually to 5000 feet where the line passes east of the towns of Bartle, Toad Mountain and Harris Mountain. The route then climbs fairly uniformly for six miles, reaching the pass between Little Glass and Pumice Stone Mountains at an elevation of 6400 feet. North of the pass the line again descends to 5000 feet over the next ten miles. The pass has light timber cover and probably a considerable amount of boulders and rock near the surface of the ground. The next 18 miles of route, passing east of Mount Dome, lies across rough lava flows partially covered with medium-sized timber. The last five miles of the section is through flat to slightly rolling cultivated land. A point on the California-Oregon border near Merrill is the north limit of Section No. 3.

About 29 miles of solid rock ditch are indicated, in addition to 25 miles of ditch through loose rock and boulders. Forty miles of the route will require clearing through medium-sized timber. There are three railroad and three highway crossings in the section, but only one creek crossing.

Section No. 4 - 84 Miles

Beginning at a point on the California-Oregon border near Merrill, Oregon, the pipeline route runs north to the vicinity of Hildebrand

through gently rolling land used mostly for grazing, but with some cultivation. Northwest of Hildebrand the terrain is a little rougher, with occasional rock outcroppings. At the same time, the timber becomes larger and more dense. From a point on the route opposite Kirk, to the northern end of Section No. 4 at Beaver Marsh, the country is fairly flat and supports dense stands of timber ranging from 6 to 12 inches in diameter.

A little more than half the length of this section is covered by timber from 6 to 24 inches in diameter. It is estimated that this section has eight miles of solid rock and 19 miles of boulders and loose rock.

In this section the line crosses the Lost, Sprague and Williamson Rivers and seven lesser creeks. There are also five highway and four railroad crossings on line.

Section No. 5 - 92 Miles

From Beaver Marsh the pipeline route runs in a northerly direction along Highway 97, past the towns of Chemult, Crescent, Lapine, Bend and Redmond. It ends near Terrebonne, Oregon. Between Beaver Marsh and Lapine, about 45 miles, the terrain is flat to gently rolling and covered with dense pines up to 24 inches in diameter. There is very little evidence of rock in this area. North of Lapine the route is a little rougher and there are frequent outcrops of volcanic rock. Correspondingly, the trees in the area are smaller and scattered.

It is estimated that 73 miles of right-of-way will require clearing through timber. Loose rock and boulders are visible over a total distance of 11 miles, while the indications are that solid rock will be found in 30 miles of line. There are ten creek crossings, four railroad and seven highway crossings in the section.

Section No. 6 - 73 Miles

The first 25 miles of Section No. 6, from Terrebonne to the vicinity of Madras, is quite smooth, with just enough soil to support some grazing and sparse pine growth. North of Madras to the vicinity of Shaniko there are several miles of barren rocky wasteland, with little or no soil cover. Beyond Shaniko to the end of the section near the John Day River, the route lies across rolling to choppy wheat land.

Roughly 40 miles of solid rock will be encountered in this section, and about 22 miles of loose rock and boulder. Except for a distance of about four miles through sparse pine growth, the route in Section No. 6 is clear of trees.

Crooked River Canyon, near Terrebonne, is in solid rock about 400 feet across and 300 feet deep. A span-type crossing is recommended here. There are six other creek crossings and three highway crossings in this 73 miles of line.

Section No. 7 - 70 Miles

Section No. 7 begins at a point just west of the John Day River and its entire length runs in a northeasterly direction. The line passes near the towns of Gwendolen and Ione and reaches the end of the section at Highway 207, nine miles south of Hermiston, Oregon.

The terrain is rolling to choppy, and is underlaid at varying depths by volcanic rock. It is estimated that, in excavating the pipe-line trench, solid rock will be struck in a total of 21 miles, while broken rock and stones will be found in another 30 miles. The land along the route is tree-less and most of it is devoted to wheat growing.

In addition to the John Day River, there are two creeks, five highways and two railroads to be crossed in Section No. 7.

Section No. 8 - 85 Miles

The southern limit of Section No. 8 is on Highway 207, nine miles south of Hermiston, Oregon. The route starts northeast for 20 miles, then swings north to cross the Oregon-Washington state line east of the Columbia River. Five miles north of the state line the route crosses the Walla Walla River, and 15 miles further north it crosses the Snake River just below the Ice Harbor Dam now under construction. The Snake River is approximately 2000 feet wide at the point of crossing. North of the crossing, the line bears to the northeast to the end of Section No. 8, three miles beyond Kahlotus, Washington.

There are two short stretches of route at the Walla Walla and Snake River crossings that are fairly rough and choppy. Otherwise, the location lies across country that ranges from flat to rolling. About two-thirds of the land along the line is cultivated for wheat growing, and the balance is used for grazing. It is probable that bed rock will be met beneath the surface of the ground for a total of 17 miles. Another 35 miles of ditch may contain loose rock mixed with the soil.

In this section there are three river and four creek crossings, as well as nine highway and eight railroad crossings.

Section No. 9 - 119 Miles

Section No. 9 begins at a point three miles northeast of Kahlotus, Washington, and ends at a point five miles southeast of Spirit Lake,

Idaho. The route runs in a northeasterly direction throughout, passing seven miles southeast of the City of Spokane.

From the start of the section to the crossing of Highway 195 near Spangle, a distance of 78 miles, the terrain is open and rolling. About 85 percent of the land crossed is cultivated. The next 22 miles to the Spokane River crossing lies through a range of choppy hills half timber covered and half farm land. A few miles beyond the river the route enters the State of Idaho. The last 19 miles of line in Section 9 traverses gently rolling country, partially timbered but for the most part cultivated or grazing land.

Surface rock and rock outcroppings are estimated to occur in a total of 13 miles of route, while loose rock and boulders will be found in an additional 36 miles. Pine trees up to 12 inches in diameter exist in a total of 20 miles of line. There are 12 creek and one river crossing as well as 17 highway and 14 railroad crossings in Section No. 9.

Section No. 10 - 91 Miles

This section starts at a point six miles southeast of Spirit Lake, Idaho. From this point to the Pend Oreille River crossing the route is generally northeast to north, running west of the town of Granite and east of Cocolalla Lake and across the river near Dover. The terrain in this 31 miles is rolling, and entirely covered by stands of pine. Continuing north, the route is smoother, and some farms have been cut out of the timber. Near Naples, the line begins a rather rapid descent to the Kootenai River over rolling choppy ground. A crossing of the Kootenai will be made just west of Bonners Ferry, where the river is 1200 feet wide. The route then follows the broad gentle valley of the Kootenai River north to Copeland, then swings east and north to the International Border near Eastport, Idaho and Kingsgate, British Columbia, where the section ends.

The right-of-way in this section will require about 67 miles of clearing. About a quarter of the timber is over 12 inches in diameter. The soil is mostly clay and gravel and only nine miles of solid rock is indicated. There may be loose rock and boulders over an additional 29 miles.

In addition to the two major river crossings there are 14 lesser river and creek crossings in this 91 miles. There are also eight highways and five railroads to cross.

Section No. 11 - 55 Miles

Section No. 11 begins at a point on the International Border near Eastport, Idaho and Kingsgate, British Columbia. The pipeline follows Highway 3 and the Moyie River in a northeasterly direction for 27 miles. In this distance it may be necessary to cross the Moyie River as many as

ten times, due to its many bends. There is at least five miles of low swampy route adjacent to the river. In leaving the Moyie River Valley, the line turns east and climbs quite rapidly to the highest point on the route, an elevation of 6600 feet. Continuing eastward, the route descends quickly to the headwaters of Tepee Creek. It parallels the creek south of Mount Connell, then crosses the Kootenay River to the end of Section No. 11, in the vicinity of Jaffray, British Columbia.

Almost all the route is covered with trees up to 12 inches in diameter. The pipeline trench will be in solid rock for about 15 miles and in a mixture of soil and loose rock for another 35 miles. There are eight highway and five railroad crossings in the section.

Section No. 12 - 63 Miles

This section begins east of the Kootenay River near Jaffray, British Columbia, and from this point the route first runs to Elko on the Elk River. For the next 15 miles, the pipeline will follow the Canadian Pacific Railway, Highway 3, and the Elk River, past Fernie and Hosmer to the vicinity of Natal. Here the route leaves the Elk River Valley, but continues to follow the highway and railway eastward through the towns of Natal and Michel and on to the British Columbia-Alberta boundary. Section No. 12 ends in Alberta three miles east of the boundary.

All but the first nine miles of this section is located in a narrow valley between high mountains. However, the valley floor is quite smooth and, except for a stretch in the vicinity of Natal and Michel, the route is not difficult. For a total distance of five miles the valley floor is completely taken up in roads, railroads, streams and towns, which will force the pipeline location to the rough choppy mountain side.

About 51 miles of the route are covered by dense stands of pines up to 12 inches in diameter. The rest of the section is virtually clear. There are seven miles of rock that will require blasting to make the pipeline trench and 33 miles where the trench contains loose rock that may be excavated by back hoes. The soil in the rest of the section is sand and gravel.

There are 30 stream crossings in Section No. 12 of which seven are crossings of the Elk River. The highway and railroad are re-crossed a total of 18 and ten times, respectively.

Section No. 13 - 52 Miles

Section No. 13 begins at a point in Crowsnest Pass, three miles east of the British Columbia-Alberta border. From this point the pipeline route runs in an easterly direction some 22 miles through or around the towns of Coleman, Blairmore, Frank, Hillcrest and Burmis, generally

paralleling Alberta Highway 3, the Canadian Pacific Railway and the Crowsnest River. About four miles east of Burmis (at Lundbreck Falls) the line swings away from the river to run due north through a broad open valley between the Livingston Range of the Rocky Mountains on the west and the Porcupine Hills on the east. A crossing of the Oldman River will be made approximately 15 miles north of Lundbreck. From there, the line continues north through gently rolling country to the terminus of Section No. 13, a point 25 miles due west of Claresholm, Alberta.

The first 15 miles of the section lies in the Crowsnest River Valley, which varies in width from a mile or more to as little as a few hundred feet and is bordered by high steep mountain sides. In places, the valley floor is almost completely taken up by the river, the highway, the railroad, settlements and mine works. During construction, working room will be quite restricted for a total distance of four to five miles in this area.

For the most part the section is clear of trees. A few scattered pine will be met in Crowsnest Valley, while clumps of brush and small trees will be found in the northern part of the section. About nine miles of trench must be cut through rock and an additional 13 miles through gravel and boulders. The remaining 30 miles, mostly in the north, should be easily excavated by a ditching machine. There are about 25 creek crossings to make in the 51 miles, as well as one crossing of the Oldman River. There are also eight highway crossings and four railroad crossings in the section.

Section No. 14 - 100 Miles

Beginning at a point 25 miles due west of Claresholm, Alberta, the pipeline route runs north and a little west for 29 miles among low hills, generally paralleling a newly-constructed highway, to the settlement of Pekisko. From Pekisko the route continues north for 17 miles, crossing the Highwood River a mile west of Longview and the Sheep River midway between the towns of Turner Valley and Black Diamond. The line swings northwest from Turner Valley, passing to the west of the small settlements of Millerville and Priddis, through the Sarcee gas field and across the Elbow River. The last 21 miles in the section lie due north, crossing the Jumping Pound and Bow Rivers about three miles west of Cochrane. The northern terminus of Section No. 14 falls at a point seven miles southwest of Dogpound, Alberta.

The terrain ranges from rolling hills to gently rolling prairie, about half of which is open grazing land or cultivated farm land and half scattered brush and small trees. The soil is mostly a sandy loam with a few gravel deposits. There are also patches of soft or wet ground, possibly totaling three miles, and mainly in creek bottoms.

In addition to the five river crossings, there are approximately 40 creek crossings in this 100 mile section. The line crosses 13 highways and one railroad.

Section No. 15 - 90 Miles

Section No. 15 starts at a point seven miles southwest of Dog-pound, Alberta. From this point, the route continues north crossing the Little Red Deer River about three miles west of Cremona and intersecting Highway 27 about three and a half miles east of Sundre. Further north, the line crosses the confluence of the Red Deer and James Rivers, crosses Highway 11 just south of Alhambra, and continues to the northern limit of Section No. 15 at a point two miles south of Medicine Lake.

The flat to gently rolling contour of the ground in this section is broken only as the line drops into small valleys cut by rivers and creeks. Possibly as much as 25 miles of the line may be across soft or wet ground. About 50 miles of the route traverses cultivated farm land, while the remaining 40 miles of line is, except for a few open spots, covered by brush and poplar and birch trees.

On line there are 16 creek and two river crossings, as well as two railroad and four highway crossings.

Section No. 16 - 120 Miles

The southern limit of the section will be the transition from 36-inch to 30-inch pipe, a point two miles directly south of Medicine Lake. From this point the line angles off to the northwest across flat to gently rolling brush land, to pass about seven miles west of Buck Lake. The route lies through the Pembina oil field, crossing the North Saskatchewan River ten miles south of Drayton Valley and the Pembina River 16 miles further on. Beyond the Pembina River, the line runs just east of Sinkhole Lake, then intersects Highway 16 south of McKay, a settlement to the west of Chip Lake. Continuing in a northwesterly direction, the pipeline will cross the McLeod River, then climb through fairly high rolling hills to reach a central point in the Windfall gas field, 40 miles north and seven miles east of the town of Edson, Alberta. This point is both the end of the mainline and the northern terminus of Section No. 16.

The terrain in this section is for the most part quite flat, with possibly as much as 50 miles of wet or soft ground. About 15 miles of the route lies across cultivated farmland, and another 20 miles is open and clear of trees. The remaining 85 miles is covered with small to medium-sized trees and brush.

In addition to the three river crossings mentioned above, there are about 13 lesser stream crossings on the route. There are two main highway crossings and one railroad crossing on line.

Section No. 17 - 66 Miles

Section No. 17 is a combination lateral line which serves both

as a receiving lateral to the mainline, connecting the Castle River and Waterton fields and as a delivery lateral to the Canadian Montana Pipeline Company at the Alberta-Montana border. Beginning at a point on the mainline just east of Burmis, Alberta, the route for the lateral runs southeast 11 miles to a central collection point in the Castle River field, then continues 13 miles southeasterly along the eastern toe of the Rocky Mountains to the gathering center for the Waterton field and then extends on in the same general southeasterly direction for a distance of 42 miles to the Alberta-Montana border where connection will be made with the Canadian Montana Pipeline Company facilities.

Except for a short rough section south of the Crowsnest River, the route to Waterton field is through rolling foothills for the most part clear of trees. The soil is sandy loam generally underlaid with gravel and small boulders and with an occasional rock outcrop.

From the Waterton field to the Alberta-Montana border the line runs over rolling open grazing country through light sand soil underlain with gravel.

Approximately fifteen creek crossings will be made in this section as well as three minor river crossings, one railroad and six highway crossings.

Section No. 18 - 14 Miles

Section No. 18, the Crossfield lateral, joins the mainline ten miles southwest of Dogpound, Alberta. From the mainline, the route of the lateral runs due east a distance of 14 miles to a central point in the Crossfield gas field.

The first nine miles of line lies across gently rolling grazing land and cultivated farm land clear of trees. The rest lies through an area of numerous small lakes, where the soil is soft or wet. About three miles of clearing through brush and small trees will be required for the lateral. Except for the wet areas, the soil is a sandy loam. A few scattered gravel deposits are indicated.

There is one creek crossing on the route of the lateral.

Section No. 19 - 38 Miles

Section No. 19 is a lateral to the Westerose South field with a branch to the Homeglen-Rimbey field. The lateral connects with the mainline where it changes from 30-inch to 36-inch pipe. This is also the junction of mainline Section Nos. 15 and 16. From this point, two miles south of Medicine Lake, the route for the lateral runs northeasterly, crossing the Canadian Pacific Railway, Highway 12 and the Blindman River, all about two miles north of the town of Bluffton. It continues northeast a total distance of 30 miles to a central point in the Westerose South gas field, 22 miles northwest of Ponoka, Alberta.

The route traverses flat to gently rolling land about seven miles of which is soft or wet ground. Thirteen miles of right-of-way will require clearing through medium dense brush and small trees. Roughly a third of the 30-mile route lies across cultivated farm land.

There are seven creek crossings to make, as well as one highway and one railroad crossing.

The Homeglen-Rimbey branch of Section No. 19 connects with the Westerose South lateral about 23 miles from the mainline. The eight miles of route for this lateral runs southeast across the north branch of the Blindman River to a central point in the Homeglen-Rimbey field, five miles northeast of Rimbey, Alberta.

About two of the eight miles lies across soft or wet ground, while four miles is through brush and small trees. The remainder is cultivated farm land.

Section No. 20 - 4 Miles

From a point on the mainline opposite the settlement of Alder Flats. The lateral will run in a northeasterly direction, perpendicular to the mainline, to a central point in the Minnehik-Buck Lake field. The field collection point is about two miles northwest of the settlement of Buck Lake, Alberta.

The route lies across flat land, a mile of which is wet. About half the route is clear of trees, the other half covered with brush and small poplar and birch trees. There is one creek crossing on line.

Section No. 21 - 65 Miles

The lateral to Pine Creek and the lateral to Virginia Hills together make up Section No. 21. Both laterals connect with the mainline at its northern terminus in the Windfall gas field, a point 40 miles north and seven miles east of Edson, Alberta. From there the route of the Pine Creek lateral runs 24 miles in a southwesterly direction, through high rolling hills covered with dense stands of poplar trees and pines up to 12 inches in diameter, to reach the Pine Creek gas field. The end of this lateral is 26 miles north and 14 miles west of Edson.

About six miles of the route lies across wet ground; otherwise the soil is sandy with a few gravel deposits. There are three creek crossings on the line.

The Virginia Hills lateral extends 41 miles in a northeasterly direction to the Virginia Hills gas field. About five and a half miles from Windfall the route crosses the Athabaska River and it crosses Highway 43 three and a half miles further on. The northern terminus of the lateral is about 40 miles north of Whitecourt, Alberta.

The terrain along the route alternates between rolling hills and wet or swampy ground. A little less than half the total route distance is wet or swampy; otherwise, the soil is sandy. The whole area was at one time covered with a dense growth of pine trees, but roughly 15 miles of the line has been burned over, leaving a tangle of deadfall and a scattered regrowth of small tamarack and pine trees.

There are approximately eight creek crossings on the route, in addition to the Athabaska River crossing. Only one highway crossing will be made on this lateral.

Climatological Data

The table on page 14 summarizes climatological data from weather stations close to the proposed pipeline route.

It was compiled from these official government publications:

Canada:

- "Facts & Figures - Alberta" - Bureau of Statistics, Alberta, 1954.
- "Climatic Summaries for Selected Meteorological Divisions, Department of Transport."
- "Climate for British Columbia" Department of Agriculture, 1954.

United States:

- "Climatic Summary of the U.S." - Supplement for 1931 through 1952 for Oregon, Washington and Montana.
- "Climatological Data", Annual Summary, 1956, for California, Oregon, Washington, Idaho and Montana.
- "Bulletin W: Climatic Summary of the U. S. prior to 1930, for California and Oregon."
- Climatological Summary sheet for points in California.
- Local Climatological Data - where available.

The elevation of each recording station, and its location with reference to the pipeline, is given.

The terms used in the Climatological Data table on page 14 are defined below:

Temperature: Record maximum and minimum (Columns (d) and (e) respectively) are the extreme temperatures during the period of recording.

In determining the normal maximum temperature, (Column f), the average of the maximum daily temperatures is computed for each calendar month of the entire period of record. The average maximum temperatures so obtained for January are

then averaged for the entire period. This procedure is followed for February, March and so on until twelve such averages are obtained. The highest of these twelve is designated as the normal maximum temperature.

In determining the normal minimum temperature (Column g), the average of the minimum daily temperatures is computed for each calendar month of the entire period of record. The average minimum temperatures so obtained for January are then averaged for the entire period. This procedure is followed for February, March and so on until twelve such averages are obtained. The lowest of these twelve is designated as the normal minimum temperature.

Precipitation: Mean monthly maximum (Column h) is the highest average monthly rainfall for the period of recording.

Mean annual precipitation (Column j) is the average of the annual rainfall plus the water equivalent of the snowfall of each of the years of the period of recording.

Snowfall: Mean annual snowfall (Column k) is the average of the annual snowfall of each of the years of the period of recording.

CLIMATOLOGICAL DATA

	Recording Station Location				Temperature				Precipitation		Mean	Number
					Record		Normal					
	Place	Pipeline Mile Post	Distance from Pipeline (miles)	Elevation (ft above s.l.)	Max. (°F)	Min. (°F)	Max. (°F)	Min. (°F)	Mear Mo. Max. (inches)	Mean Annual (inches)	Annual Snowfall (inches)	of Years of Record
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(j)	(k)	(l)
1.	Antioch, California	1	2 W.	46	103	23	92	37	2.59	12.53	-	78
2.	Davis Ag. College, California	38	14 E.	51	108	22	95	35	3.52	16.72	-	85
3.	Colusa, California	87	13 E.	60	110	17	95	37	3.23	15.95	-	51-77
4.	Orland, California	126	3 E.	254	109	22	99	37	3.44	17.86	2	73
5.	Red Bluff, California	154	1 E.	341	115	17	99	37	4.23	21.68	3.0	78-85
6.	Redding, California	186	14 W.	569	111	27	97	37	7.19	37.40	-	81
7.	Mt. Shasta, California	246	28 W.	3544	97	5	85	24	5.40	33.89	106	43-69
8.	Mt. Hebron, California	280	18 W.	4250	95	-15	84	4	2.59	11.24	24	6-14
9.	Klamath Falls, Oregon	307	11 W.	4090	105	-24	85	21	2.20	13.83	48.0	22
10.	Chiloquin, Oregon	340	10 W.	4200	103	-28	84	15	2.84	16.70	58.2	22
11.	Chemult, Oregon	385	0	4760	102	-30	83	10	5.20	27.38	165.0	14
12.	Wickiup Dam, Oregon	422	9 W.	4330	101	-40	80	8	3.40	20.80	78.4	11
13.	Bend, Oregon	452	3 E.	3599	104	-26	83	20	1.74	12.14	31.6	22
14.	Madras, Oregon	495	1 E.	2300	112	-45	88	19	1.19	9.03	14.6	21
15.	Antelope, Oregon	519	10 E.	2690	107	-27	87	20	1.61	12.48	23.0	20
16.	Condon, Oregon	557	6 E.	2909	111	-25	84	21	1.42	12.16	32.6	21
17.	Morgan, Oregon	582	6 N.	793	-	-	-	-	1.22	9.17	12.0	22
18.	Hermiston, Oregon	620	4 S.	624	112	-37	92	22	1.16	8.51	10.8	22
19.	Kennewick, Washington	663	16 W.	392	115	-29	92	24	1.11	7.44	13.2	22
20.	Kahlotus, Washington	694	1 W.	1350	-	-	-	-	1.58	10.17	11.2	22
21.	Sprague, Washington	760	15 W.	1895	109	-35	88	18	2.29	14.70	20.5	22
22.	Spokane, Washington	787	12 W.	2357	108	-30	82	20	2.18	16.05	45.1	75
23.	Coeur d'Alene, Idaho	798	18 E.	2152	103	-12	-	-	3.31	24.35	-	42
24.	Sandpoint, Idaho	854	2 E.	2100	93	-16	84	18	4.35	29.10	72	45
25.	Porthill, Idaho	900	7 N.W.	1665	96	-15	80	16	2.35	19.29	69	60
26.	Cranbrook, B.C.	937	17 N.	3019	96	-28	63	17	1.80	14.41	56.7	38
27.	Fernie, B.C.	995	0	3305	92	-39	63	17	5.53	38.88	131.3	2-25
28.	Coleman, Alberta	1032	0	4312	-	-	-	-	2.76	19.73	79.8	30
29.	Pincher Creek, Alberta	1051	14 S.E.	3771	96	-44	77	10	4.04	20.99	82.9	30
30.	Lundbreck, Alberta	1051	2 S.E.	3918	114	-52	78	3	3.57	18.46	79.3	30
31.	Claresholm, Alberta	1081	25 E.	3395	93	-18	-	-	2.16	14.04	58.5	2-35
32.	Calgary, Alberta	1147	17 E.	3540	97	-46	76	5	3.48	17.47	57.0	30
33.	Olds, Alberta	1207	19 E.	3413	99	-46	74	2	3.31	17.56	50.4	30
34.	Red Deer, Alberta	1241	35 E.	2870	88	-48	73	-1	3.92	20.63	48.9	2-35
35.	Wetaskiwin, Alberta	1292	65 E.	2480	99	-55	76	-2	2.93	17.44	53.0	30
36.	Calmar, Alberta	1313	58 E.	2200	98	-57	75	-5	3.13	18.27	49.9	30
37.	Edmonton, Alberta	1338	80 E.	2219	99	-55	75	-1	3.11	17.63	52.9	30
38.	Edson, Alberta	1338	36 W.	2985	100	-55	74	-1	3.53	19.91	58.4	30

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

FLOW DIAGRAM

NET THROUGHPUT 400 MMcfd

ALBERTA AND SOUTHERN GAS CO. LTD.

FLOW DIAGRAM - 400 MMcfd NET DELIVERY TO ANTIOCH

The flow diagram shows operating conditions for the pipeline and compressor stations for an export of 450 MMcfd from Alberta, distributed as follows:

To Antioch	400.0 MMcfd
To Canadian Montana Pipe Line Company	30.0
Off-line deliveries	10.0
Compressor fuel	6.4
Losses	3.6
	450.0

Provision has been made in the design of the mainline in Alberta for delivery of gas to the Canadian Western Natural Gas Company Ltd., The Northwestern Utilities, Ltd. and the Canadian Montana Pipeline Company as shown in the diagram.

Daily volumes of gas indicated on the chart for each field are the assumed maximum daily rates for which the receiving laterals and other facilities for handling the gas from each field have been designed. These volumes allow for peak and emergency operating conditions. Coincident deliveries from all fields at these rates are not anticipated.

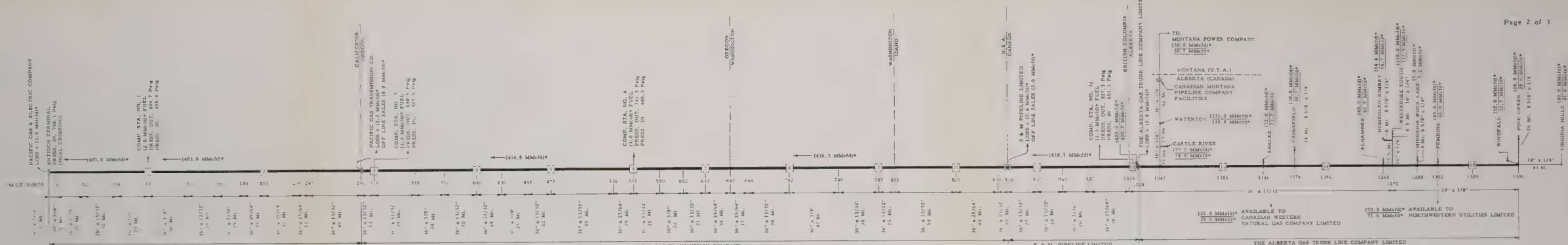
The pipeline has been designed to provide storage in the south end in excess of normal line pack. The flow diagram shows operating conditions when 40 MMcf of gas are in storage.

Stations 12 and 3 each have one spare compressor unit for operating conditions shown.

Field pressures are great enough to make a pipeline compressor station unnecessary in Alberta.

The pipeline profile and pressure gradients for 400 MMcfd net at Antioch are included in this exhibit.

The volumes expressed in this exhibit are based on a 14.73 lbs. per square inch pressure base. However, some totals have been also presented using 14.4 lbs. per square inch pressure base. These totals are clearly marked.



			COMPRESSOR STATIONS															
			STATION NO. 1 MILE POST 93 (a)		STATION NO. 3 MILE POST 309 (b)			STATION NO. 6 MILE POST 555 (c)					STATION NO. 12 MILE POST 1025 (d)					TOTAL (e)
1	Line Pressure Entering Station	Psig	490.4		469.5			480.3					601.3					
2	Compressor Suction Pressure	Psig	482.4		461.5			472.3					593.3					
3	Barometric Pressure	Psia	14.6		12.5			13.7					12.7					
4	Compressor Suction Pressure	Psia	497.0		474.0			486.0					606.0					
5	Compressor Discharge Pressure	Psia	821.3		655.0			757.0					842.0					
6	Compressor Discharge Pressure	Psig	806.7		642.5			743.3					829.3					
7	Line Pressure Leaving Station	Psig	806.7		640.5			741.3					827.3					
8	Compression Ratio		1.653		1.382			1.558					1.390					
9	BHP/MMcfd Excluding Deviation		28.10		18.39			24.75					18.60					
10	Deviation at Suction Conditions		1.090		1.086			1.088					1.112					
	BHP/MMcfd Including Deviation		25.78		16.95			22.75					16.72					
12	Volume Into Station MMcfd		403.0		414.5			416.3					420.0					
13	Station Fuel MMcfd		2.0		1.3			1.8					1.3					6.4
14	Volume Out of Station MMcfd		401.0		413.2			414.5					418.7					
15	Operating BHP Required for Volume Out of Station		10,340.0		7,000.0			9,430.0					7,000.0					33,770
16	No. of 3500 BHP Compressors Installed		3		3			3					3					12
	Total Installed HP		10,500.0		10,500.0			10,500.0					10,500.0					42,000

NOTE

Pressures between Compressor Station No. 1 and Antioch are at the end of the packing period. Refer to the Pressure Gradient Chart for pressures at the end of the draft period.

The minimum delivery pressure specified by contract is 900 psig

( )* Figures shown in parenthesis are based on a 14.73 psia pressure base

* Figures designated in this manner are based on a 14.4 psia pressure base.

LEGEND

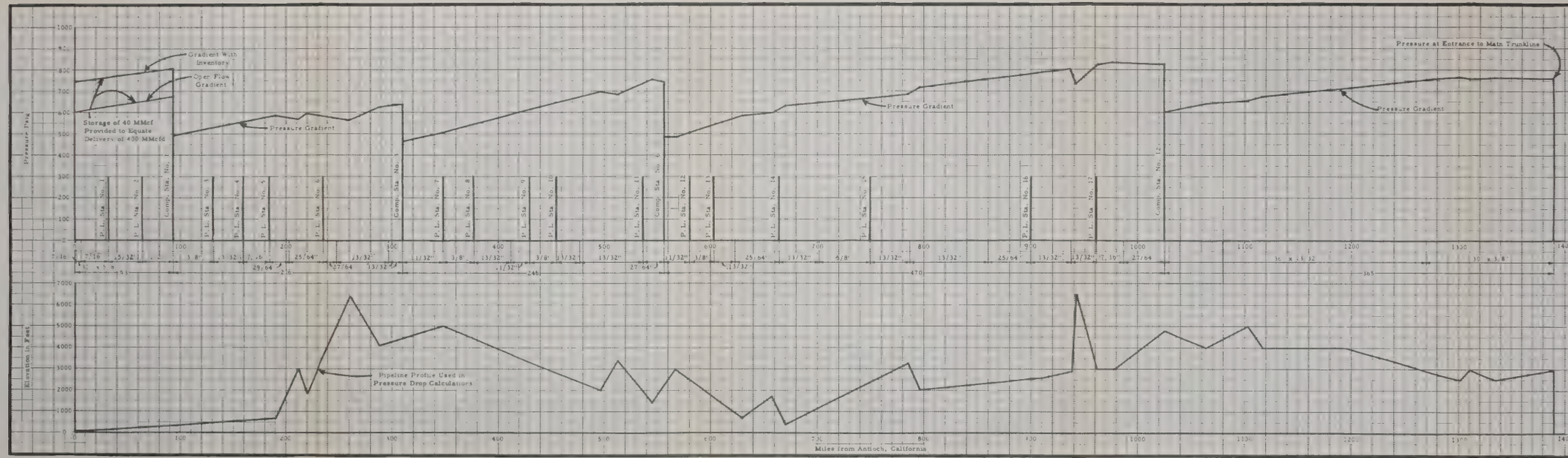
- COMPRESSOR STATION
- FUTURE COMPRESSOR STATION
- METER STATION

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA-CALIFORNIA PROJECT

DESIGN FLOW DIAGRAM SHOWING 400MMcfd. NET TO ANTIOCH

OCTOBER 8, 1957



NOTE:

Based on 14.73 psia, Delivery at Antioch is 400 MMcfd

Based on 14.4 psia, Delivery at Antioch is 409 MMcfd

KEY

Wall Thickness to Working Pressure

36" OD API 5LX52

11/32" = WP 715#	7/16" = WP 911#
3/8 " = WP 780#	29/64" = WP 942#
25/64" = WP 812#	15/32" = WP 975#
13/32" = WP 844#	1/2 " = WP 1040#
27/64" = WP 877#	

30" OD API 5LX52

3/8" = WP 936#

30" OD API Gr B

5/8" = WP 1050#

BECHTEL CORPORATION

SAN FRANCISCO

ALBERTA - CALIFORNIA PROJECT

DESIGN PRESSURE GRADIENT FOR 400 MMcfd. NET TO ANTIOCH

October 8, 1957

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

FLOW DIAGRAM

MAXIMUM CAPABILITY

ALBERTA AND SOUTHERN GAS CO. LTD.

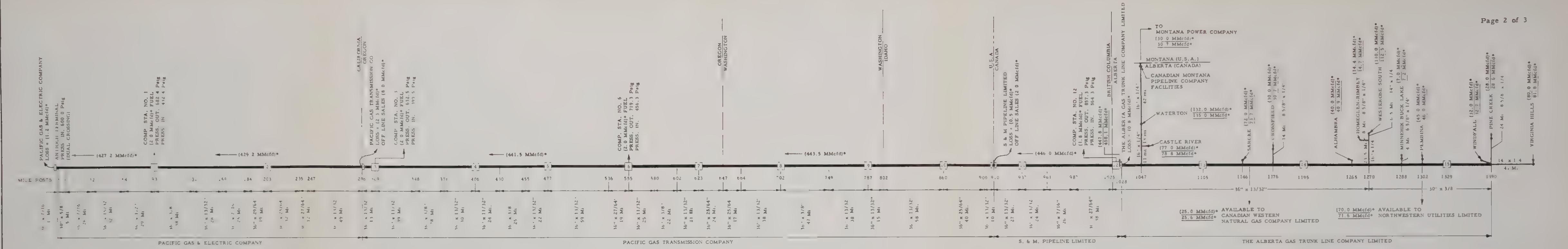
FLOW DIAGRAM - MAXIMUM CAPABILITY

The maximum capability of the system is the maximum delivery to Antioch obtained by operating all stations at the maximum useable installed horsepower. Delivery to Antioch is at the 600 psig minimum delivery pressure. Off line deliveries are the same as those on the flow diagram showing 400 MMcfd net to Antioch.

Under these operating conditions, the net delivery to Antioch is 426 MMcfd.

Pipeline profile and pressure gradient for these conditions are included in this exhibit.

The volumes expressed in this exhibit are based on a 14.73 lbs. per square inch pressure base. However, some totals have been also presented using 14.4 lbs. per square inch pressure base. These totals are clearly marked.



			COMPRESSOR STATIONS				
			STATION NO. 1 MILE POST 93 (a)	STATION NO. 3 MILE POST 309 (b)	STATION NO. 6 MILE POST 555 (c)	STATION NO. 12 MILE POST 1025 (d)	TOTAL (e)
	Line Pressure Entering Station	Psig	432 4	399 5	456.3	564.3	
2	Compressor Suction Pressure	Psig	424 4	391 5	448.3	556.3	
3	Barometric Pressure	Psia	14 6	12 5	13 7	12 7	
4	Compressor Suction Pressure	Psia	439 0	404 0	462 0	569 0	
5	Compressor Discharge Pressure	Psia	699 0	647 0	735 0	872.0	
6	Compressor Discharge Pressure	Psig	684 4	634 5	721 3	859 3	
7	Line Pressure Leaving Station	Psig	682 4	632 5	719 3	857 3	
8	Compression Ratio		1 592	1 602	1 590	1 533	
9	BHP/MMcfd Excluding Deviation		26 10	26 25	25 83	24.00	
10	Deviation at Suction Conditions		1 078	1 072	1 084	1 105	
	BHP/MMcfd Including Deviation		24 2[illegible]	24 49	23 83	21 72	
12	Volume Into Station MMcfd		429 2	441 5	443 5	447 8	
13	Station Fuel MMcfd		2 0	2.0	2 0	1 8	[illegible] 8
14	Volume Out of Station MMcfd		427 2	439 5	441 5	446 0	
15	Operating BHP Required for Volume Out of Station		10 340 0	10,500.0	10,500.0	9,670 0	41,010.0
16	No of 3500 BHP Compressors Installed		3	3	3	3	12
17	Total Installed HP		10,500.0	10 500 0	10,500 0	10,500 0	42,000.0

NOTE

Pressures between Compressor Station No. 1 and Antioch are at the end of the packing period Refer to the Pressure Gradient Chart for pressures at the end of the draft period.

The minimum delivery pressure specified by contract is 900 psig.

( )* Figures shown in parenthesis are based on a 14.73 psia pressure base

____ * Figures designated in this manner are based on a 14 4 psia pressure base

LEGEND

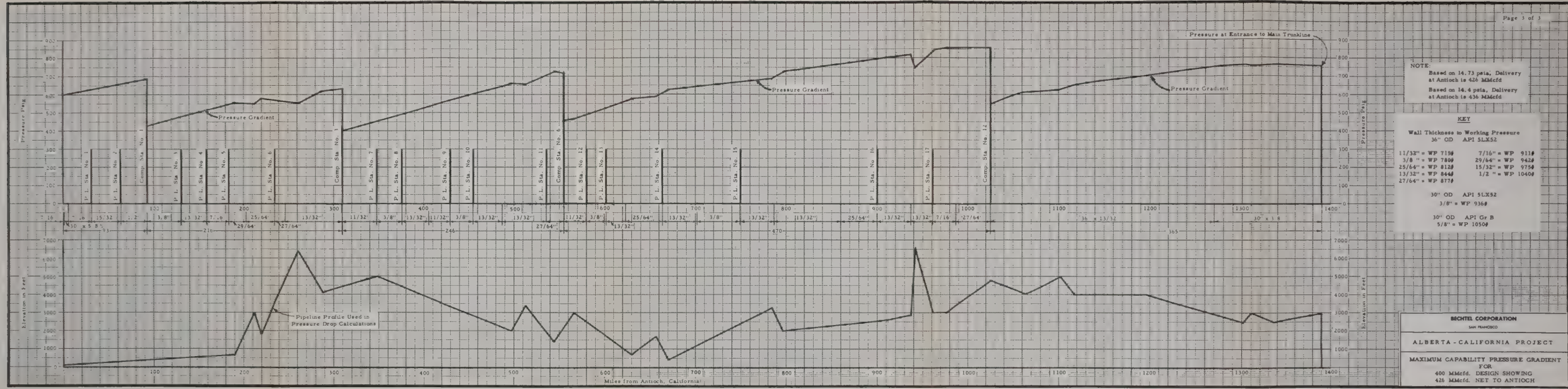
- COMPRESSOR STATION
- FUTURE COMPRESSOR STATION
- METER STATION

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA - CALIFORNIA PROJECT

MAXIMUM CAPABILITY FLOW DIAGRAM FOR 400MM cfd. DESIGN SHOWING 426MMcfd NET TO ANTIOCH

OCTOBER 8, 1957



NOTE

Based on 14.73 psia, Delivery at Antioch is 426 MMcfd

Based on 14.4 psia, Delivery at Antioch is 436 MMcfd

KEY

Wall Thickness to Working Pressure

36" OD API 5LX52

11/32" = WP 715#	7/16" = WP 911#
3/8 " = WP 780#	29/64" = WP 942#
25/64" = WP 812#	15/32" = WP 975#
13/32" = WP 844#	1/2 " = WP 1040#
27/64" = WP 877#	

30" OD API 5LX52

3/8" = WP 936#

30" OD API Gr B

5/8" = WP 1050#

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA - CALIFORNIA PROJECT

MAXIMUM CAPABILITY PRESSURE GRADIENT FOR
400 MMcfd. DESIGN SHOWING
426 MMcfd. NET TO ANTIOCH

October 8, 1957

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

FLOW DIAGRAM DATA

ALBERTA AND SOUTHERN GAS CO. LTD.

FLOW DIAGRAM DATA

The following is the flow formula used for calculating pressure drops and pipeline reinforcements.

$$KQ^2Lf = Y(P_1^2 - P_2^2) + Y^2 \Delta h(P_1 + P_2)^2$$

The formula is the classical flow equation adjusted for elevation. The elevations used are those shown on the pipeline profile.

The nomenclature for the formula is as follows:

P_1 = Upstream pressure, pounds per square inch absolute

P_2 = Downstream pressure, pounds per square inch absolute

Y = Deviation from Boyle's Law

Q = Volume in millions of cubic feet per hour flowing in the pipeline sections expressed as gas at 60°F. and 14.73 psia

$$\Delta h = \frac{Sh\ 520}{1881 \times 14.73 \times 2xT} = \frac{0.009384 \times Sh}{T}$$

S = Specific gravity of gas = 0.645, air = 1.0

h = Change in elevation of pipeline gradient in feet; positive for downhill flow and negative for uphill flow

T = Absolute temperature of gas, degrees Fahrenheit

$$K = \frac{ST \times 10^{12}}{6.25 \times D^5 \times 520}$$

D = Inside diameter of pipeline, considered to be 35.19" I.D.

L = Distance between changes in elevation in miles

f = Friction factor = 0.0023

The deviation Y was determined by method of R. V. Dunkle for a natural gas with 2.9% nitrogen. (See P.C.G.A. Proceedings, Volume 35, Page 80 for "Deviation of Natural Gas from Boyle's Law" by R. V. Dunkle).

The following are the considerations controlling the pipeline design and flow data:

1. The design flow temperature is considered to be 60°F.

2. The open flow delivery pressure at Antioch is 600 psig.

3. 40 million cubic feet of storage space is provided in the section between Station No. 1 and Antioch for the 400 MMcfd case.

4. The maximum working pressure of this pipeline is considered to be equal to or less than 72% of the guaranteed transverse yield stress.

5. The pipeline was designed with a tapered wall thickness to minimize steel requirements and at the same time provide for future increases in pipeline deliveries.

6. The station pressure loss is considered to be 8 psi on the suction and 2 psi on the discharge of the compressors.

7. Fuel is considered to be 8 cubic feet per horsepower hour.

8. Line losses have been taken at 1% of the delivered gas volume and prorated over the length of the line. The loss for each company's section is shown at its sales meter.

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

PIPELINE SPECIFICATIONS

ALBERTA AND SOUTHERN GAS CO. LTD.

PIPELINE SPECIFICATIONS

The pipeline will be designed and constructed in accordance with the American Standard Code for Gas Transmission and Distribution Piping Systems, ASA B31.1.8-1955, and all applicable codes and ordinances of the jurisdictions involved.

SPECIFICATIONS FOR MATERIAL

The pipe to be used on this project will conform to API 5LX, API 5L and ASTM Specifications. Each length of pipe will be hydrostatically tested to a pressure which will produce a stress of 90% of the specified minimum transverse yield strength. The test pressures and specifications for the various pipe sizes are specified as follows:

Pipe Size	Specification	Test Pressure psig
36"x 1-1/16"	ASTM A381 Y-42	2,231
36" x 3/4"	API 5LX 42	1,575
36" x 1/2"	API 5LX 52	1,300
36" x 1/2"	API 5LX 52*	1,300
36" x 1/2"	API 5LX 46	1,150
36" x 15/32"	API 5LX 52	1,218
36" x 29/64"	API 5LX 52	1,177
36" x 7/16"	API 5LX 52	1,138
36" x 27/64"	API 5LX 52	1,096
36" x 13/32"	API 5LX 52	1,055
36" x 25/64"	API 5LX 52	1,015
36" x 3/8"	API 5LX 52	975
36" x 11/32"	API 5LX 52	894
30" x 5/8"	API 5L Gr. B	1,312
30" x 3/8"	API 5LX 52	1,170
24" x 5/16"	API 5LX 52	1,216
18" x 9/16"	ASTM A381 Y-42	2,360
18" x 1/4"	API 5LX 52	1,300
16" x 15/32"	ASTM A381 Y-42	2,216
16" x 1/4"	API 5LX 42	1,181
14" x 1/4"	API 5LX 42	1,350
12-3/4" x 1/4"	API 5L Gr. B, or ASTM A106-B	1,235
10-3/4" x 1/4"	API 5L Gr. B, or ASTM A106-B	1,465
8-5/8" x 1/4"	API 5L Gr. B, or ASTM A106-B	1,826
6-5/8" x 1/4"	API 5L Gr. B, or ASTM A106-B	2,377

*Aluminum Killed

All valves shall be designed to meet the maximum operating conditions of the section of pipeline in which they are to be installed and conform to the following:

Valve Size	Type	ASA Rating
36" x 30"	Plug, Venturi, W.E.	400
36" x 30"	Plug, Venturi, W.E.	600
30" x 30"	Plug, Venturi, W.E.	400
30" x 30"	Plug, Venturi, W.E.	600
18" x 18"	Plug, Venturi, W.E.	400
½2" x ½2"	Plug, Venturi, W.E.	400
10" x 10"	Plug, Venturi, W.E.	400
8" x 8"	Plug, Venturi, W.E.	400
6" x 6"	Plug, Venturi, W.E.	400

Fittings, welding elbows, tees, etc. will be of steel manufactured or fabircated to conform with approved ASA standards and designed to meet the maximum operating conditions of the section of pipeline in which they are to be installed.

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

CONSTRUCTION SCHEDULE AND CASH FLOW SCHEDULE

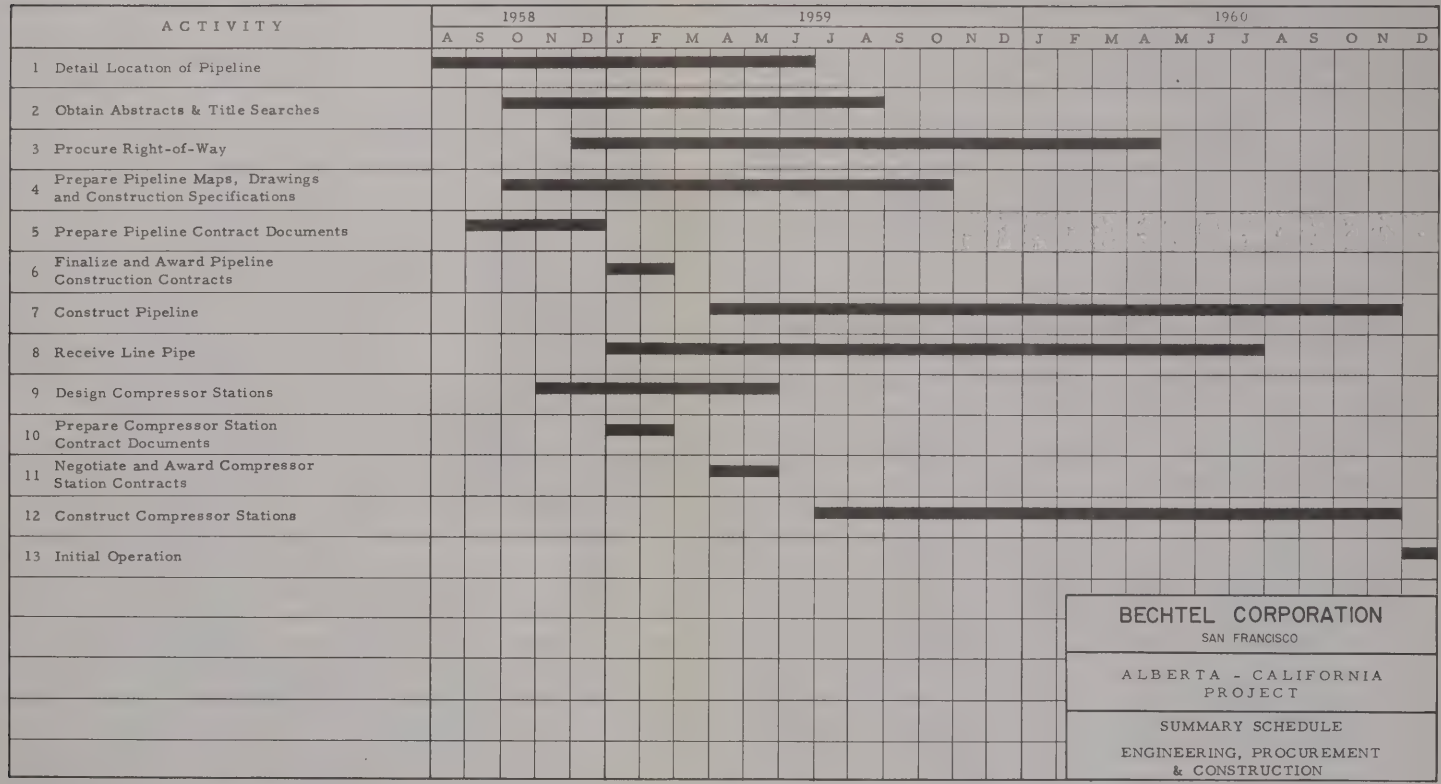
ALBERTA AND SOUTHERN GAS CO. LTD.

SUMMARY SCHEDULE AND CASH REQUIREMENT SCHEDULE

The following Summary Schedule presents an economical and feasible program leading to initial operation of the system in late 1960.

The schedule considers the effect of terrain and weather on construction time. It also takes account of other items such as necessary lead time for purchasing, the availability and deliverability of materials, and the necessary lead time from beginning the design to starting the construction.

The Cash Requirement Schedule shows the expenditures needed in each quarter through 1960, by each company, to meet the Summary Schedule dates. It is based on the Capital Cost Estimate Exhibit.


ACTIVITY
1958
A S O N D
1959
J F M A M J J A S O N D
1960
J F M A M J J A S O N D
1 Detail Location of Pipeline
2 Obtain Abstracts & Title Searches
3 Procure Right-of-Way
4 Prepare Pipeline Maps, Drawings and Construction Specifications
5 Prepare Pipeline Contract Documents
6 Finalize and Award Pipeline Construction Contracts
7 Construct Pipeline
8 Receive Line Pipe
9 Design Compressor Stations
10 Prepare Compressor Station Contract Documents
11 Negotiate and Award Compressor Station Contracts
12 Construct Compressor Stations
13 Initial Operation
BECHTEL CORPORATION
SAN FRANCISCO
ALBERTA - CALIFORNIA PROJECT
SUMMARY SCHEDULE
ENGINEERING, PROCUREMENT & CONSTRUCTION

ALBERTA - CALIFORNIA PROJECT

CASH REQUIREMENT SCHEDULE

(In Thousands of Dollars)

	P. G. & E.		P.G.T.		S & M		A.G.T.L.		A & S.G.		TOTAL	
	Quarter	Cumulative	Quarter	Cumulative	Quarter	Cumulative	Quarter	Cumulative	Quarter	Cumulative	Quarter	Cumulative
Prior to Aug., 1958	--	1,300	--	1,200	--	300	--	800	--	600	--	4,200
Aug. & Sept., 1958	330	1,630	850	2,050	210	510	290	1,090	60	660	1,740	5,940
4 Q	710	2,340	1,540	3,590	380	890	710	1,800	130	790	3,470	9,410
1 Q, 1959	940	3,280	14,240	17,830	630	1,520	10,910	12,710	130	920	26,850	36,260
2 Q	14,040	17,320	16,760	34,590	2,880	4,400	7,210	19,920	130	1,050	41,020	77,280
3 Q	16,430	33,750	11,010	45,600	11,410	15,810	18,250	38,170	130	1,180	57,230	134,510
4 Q	7,920	41,670	12,170	57,770	4,830	20,640	14,140	52,310	130	1,310	39,190	173,700
1 Q, 1960	8,500	50,170	16,450	74,220	2,060	22,700	10,120	62,430	130	1,440	37,260	210,960
2 Q	10,610	60,780	33,360	107,580	6,830	29,530	11,830	74,260	120	1,560	62,750	273,710
3 Q	5,770	66,550	14,410	121,990	7,690	37,220	17,700	91,960	120	1,680	45,690	319,400
4 Q	847	67,397	710	122,700	706	37,926	3,575	95,535	116	1,796	5,954	325,354

Hearing No. .....

Exhibit No. .....

Date .....

Witness .....

CAPITAL COST ESTIMATE

ALBERTA AND SOUTHERN GAS CO. LTD.

TABLE OF CONTENTS

CAPITAL COST ESTIMATE

10/8/57

CAPITAL COST ESTIMATE

INTRODUCTION

This exhibit provides an estimate of the total capital cost for the 1390 miles of transmission main and 187 miles of lateral lines required to make a net delivery of 400 million cubic feet of gas per day to the Antioch Terminal in California and 30 million cubic feet of gas per day to the Canadian Montana Pipeline Company at the Alberta-Montana border.

Separate estimates have been made for each of the five companies involved.

Estimates are in U. S. dollars, based on present day prices. An escalation allowance has been provided to project the costs to the end of 1960 when construction is expected to be completed. Each estimate is classified by the following items:

Item 1 - Land

The estimated cost for the purchase of property for all compressor stations (including future stations), meter and regulating stations, and maintenance building sites.

Item 2 - Rights of Way

The estimated cost of rights of way for the proposed transmission main and laterals, including cost of acquisition, surveys and timber.

Item 3 - Structures and Improvements

The estimated cost of maintenance and administrative buildings and site improvements.

Item 4 - Transmission Main

The estimated cost of all pipeline material and the installation cost for the proposed pipeline, including all applicable duty and taxes.

Pipe costs are based on United States mill prices with freight estimated on deliveries from Geneva, Utah to stock piling points along the route. In cases where the pipe is delivered into Canada, duty and

taxes have been applied to the freight costs inside the United States. Duty and tax payments are shown as a separate item.

Construction types mentioned in this exhibit are as defined by American Standards Association B31.1, Code for Pressure Piping, Section 8, Gas Transmission and Distribution Piping Systems.

In addition to mainline pipe, Item 4 includes the cost of protective coating materials, highway and railroad casing and fittings, concrete weights, anchors, mainline valves and connections, miscellaneous materials, the applicable duties and taxes on these materials, and the pipeline installation cost. The mainline valves and connections include the cost of transition pieces, blowoffs, operators and other minor appurtenances. The installation cost includes the cost of continuous concrete coating for understream and wet area crossings, the cost of the structural steel for aerial crossings as well as company and contractor costs.

Item 5 - Compressor Stations

Item 5 includes mainline compressors, power generators, water supply system, cooling equipment, oil tanks and cleaning equipment, all instrumentation and control equipment, buildings, and miscellaneous structures and equipment. The installed cost of the plants was estimated in detail and was converted to a unit cost per BHP for each plant. It includes material, installation, and applicable duties and taxes, but excludes escalation and overhead. An estimated seventy percent of the cost will be for material, and the balance for installation.

Item 6 - Measurement and Regulation

The estimated cost of all metering and pressure regulating facilities required for the proposed throughput.

Item 7 - Roads and Trails

The estimated cost of maintenance roads and trails along the proposed transmission main and laterals.

Item 8 - Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment

The estimated purchase cost of vehicles, maintenance tools and work equipment, office and laboratory equipment, and furniture and supplies, all for operation and maintenance of the completed transmission system.

Item 9 - Communications

The estimated cost of the communication system for the completed transmission system.

Item 10 - Total Direct Cost without Escalation

All costs for Items 1 through 9.

Item 11 - Escalation

An allowance of 12-1/2 percent has been applied to the total direct cost. The allowance is based on a 5 percent escalation per year, with expenditures starting in July, 1958 and ending December, 1960.

Item 12 - Total Direct Cost with Escalation

All direct costs, including escalation.

Item 13 - Overhead

The estimated cost of engineering and management, ad valorem taxes, omissions and contingencies, interest during construction, and currency exchange losses.

Item 14 - Corporate Organization Expense

All expenses borne by the transmission companies in forming their organizations.

Item 15 - Total less Working Capital

All direct costs, including escalation, overhead and corporate organization expense.

Item 16 - Working Capital

The estimated cost of initial materials and supplies inventory, the gas inventory and working cash requirements.

Item 17 - Total Project Cost

The total estimated cost of the transmission system, including all items previously mentioned.

The rest of this exhibit presents data used as backup for the detail cost estimates. Following the estimates is a Facilities Diagram showing, in line diagram form, the location of pipe by size and the location of major appurtenances along the transmission main and lateral lines.

The last portion of the exhibit is devoted to drawings of typical compressor stations, meter stations, mainline valves, and appurtenances to the pipeline.

Alberta-California Project

CAPITAL COST ESTIMATE

1390 Miles of Transmission Main
145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

TOTAL PROJECT SUMMARY

Item No.	Description	P.G.&E.Co. Total Cost	P.G.T.Co. Total Cost	S&M Co.Ltd. Total Cost	AGTL Co.Ltd. Total Cost	A&SG Co.Ltd. Total Cost	Project Total Cost
1	Land	$ 33,000	$ 68,000	$ 6,000	$ 30,000	$ --	$ 137,000
2	Rights of Way	1,214,000	2,328,000	462,000	881,000	--	4,885,000
3	Structures and Improvements	155,000	281,000	67,000	320,000	--	823,000
4	Transmission Main	47,337,000	83,867,000	23,451,000	69,597,000		224,252,000
5	Compressor Stations	3,080,000	5,736,000	3,317,000	--	--	12,133,000
6	Measurement and Regulation	1,161,000	1,210,000	637,000	288,000	--	3,296,000
7	Roads and Trails	315,000	130,000	100,000	305,000	--	850,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture & Laboratory Equipment	310,000	265,000	130,000	225,000	50,000	980,000
9	Communications	125,000	185,000	80,000	198,000	--	588,000
10	Total Direct Cost without Escalation	$53,730,000	$ 94,070,000	$28,250,000	$71,844,000	$ 50,000	$247,944,000
11	Escalation 12-1/2%	6,716,000	11,759,000	3,531,000	8,981,000	6,000	30,993,000
12	Total Direct Cost with Escalation	$60,446,000	$105,829,000	$31,781,000	$80,825,000	$ 56,000	$278,937,000
13	Overhead	6,951,000	15,451,000	5,435,000	14,710,000	--	42,547,000
14	Corporate Organization Expense	--	1,420,000	710,000	--	1,740,000	3,870,000
15	Total Less Working Capital	$67,397,000	$122,700,000	$37,926,000	$95,535,000	$ 1,796,000	$325,354,000
16	Working Capital	453,000	793,000	238,000	500,000	200,000	2,184,000
17	Total Project Cost	$67,850,000	$123,493,000	$38,164,000	$96,035,000	$ 1,996,000	$327,538,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

SUMMARY

Item No.	Description	Total Cost
1	Land	$ 33,000
2	Rights of Way	1,214,000
3	Structures and Improvements	155,000
4	Transmission Main	47,337,000
5	Compressor Station	3,080,000
6	Measurement and Regulation	1,161,000
7	Roads and Trails	315,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment	310,000
9	Communications	125,000
10	Total Direct Cost without Escalation	$53,730,000
11	Escalation	6,716,000
12	Total Direct Cost with Escalation	$60,446,000
13	Overhead	6,951,000
14	Corporate Organization Expense	--
15	Total Less Working Capital	$67,397,000
16	Working Capital	453,000
17	Total Project Cost	$67,850,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 1 - LAND

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Compressor Station	Acre	40	500	$20,000
2)	Meter and Regulating Stations	Acre	4	2,150	8,600
3)	Miscellaneous Land	Acre	7	630	4,400
4)	TOTAL COST ITEM 1				$33,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 2 - RIGHTS OF WAY

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Survey	Mile	296	910	$ 269,400
2)	Acquisition	Mile	296	360	106,600
3)	Purchase Price	Mile	296	1,091	322,900
4)	Timber	Mile	85	6,060	515,100
5)			TOTAL COST ITEM 2		$1,214,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quanity (b)	Unit Cost (c)	Total (d)
PIPE - MAINLINE, f.o.b. mill				
1) 29 Mi.of 36"x.500 5LX52 Type "A" Construction	Ton	14,513	186.93	$ 2,712,900
2) 32 Mi.of 36"x.469 5LX52 Type "A" Construction	Ton	15,027	187.92	2,823,900
3) 19 Mi.of 36"x.453 5LX52 Type "A" Construction	Ton	8,619	191.63	1,651,700
4) 51.8 Mi.of 36:x.438 5LX52 Type "A" Construction	Ton	22,724	187.92	4,270,300
5) 12 Mi.of 36"x.422 5LX52 Type "A" Construction	Ton	5,080	191.36	972,100
6) 77 Mi.of 36"x.406 5LX52 Type "A" Construction	Ton	31,393	187.96	5,900,600
7) 32 Mi.of 36"x.391 5LX52 Type "A" Construction	Ton	12,531	191.70	2,402,200
8) 38 Mi.of 36"x.375 5LX52 Type "A" Construction	Ton	14,314	187.89	2,689,300
9) 10.5 Mi.of 30" x.625 Gr.B Underwater Dual Crossings	Ton	5,408	194.15	1,050,000
10) Total				$24,473,000
FREIGHT ON PIPE				
11) Freight	Ton	129,609	19.30	$ 2,501,400
PROTECTIVE COATING - including freight				
12) Primer	U.S.Gal.	31,530	.504	$ 15,900
13) Filled Enamel Asphalt	Ton	9,921	53.43	530,100
14) Inner Wrap	Square	166,530	.95	158,200
15) Outer Wrap	Square	175,220	1.67	292,600
16) Polyken Tape	Square	3,570	12.63	45,100
17) Felt Wrap	Square	4,200	1.67	7,000
18) Total				$ 1,048,900

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
HIGHWAY AND RAILROAD CROSSINGS				
1) 40"x.375 5LX42 Casing and Fittings	Foot	8,000	23.30	$ 186,400
CONCRETE WEIGHTS				
2) River 36" I.D.-7,100#	Each	1,800	177.45	$ 319,400
3) Swamp 36" I.D.-7,100#	Each	500	177.45	88,700
4) Chance Anchors - 36"	Set	160	23.75	3,800
5) Total				$ 411,900
VALVES AND CONNECTIONS				
6) 36"x30" Mainline Plug Valves and Fittings	Each	17	27,000	$ 459,000
7) 30" Dual River Crossing Connection	Each	2	67,950	135,900
8) 36" Compressor Station Connection	Each	2	77,500	155,000
9) Mainline Meter Station Connections	Each	1	24,100	24,100
10) Manufactured Bends	Lot	--	--	30,000
11) Electrolysis Leads	Lot	--	--	5,000
12) Total				$ 809,000
MISCELLANEOUS MATERIALS				
13) Miscellaneous Materials	Lot	--	--	$ 455,900
CALIFORNIA STATE TAX				
14) Pipe @ 3%				$ 734,200
15) Materials Other Than Pipe @ 3%				87,400
16) Total				$ 821,600
MAINLINE INSTALLATION				
17) Contract and Company Cost-Foot (296 Miles-1,562,880 ft.)		--	10.64	$16,628,900
18) TOTAL COST ITEM 4				$47,337,000

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Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 5 - COMPRESSOR STATION

Station Location	Number of Compressors to be Installed (a)	Standard BHP to be Installed (b)	Cost Per BHP $ (c)	Total $ (d)
1) M.P. 93	3	10,500	293.33	$ 3,080,000
2)		TOTAL COST ITEM 5		$ 3,080,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 6 - MEASUREMENT AND REGULATION

		Unit (a)	Quantity (b)	Total (c)
1)	Antioch Terminal and Station By-Pass	Each	1	$ 713,900
2)	Pressure Limiting Station, complete	Each	1	115,700
3)	Pressure Limiting Stations, skeleton	Each	5	331,400
4)	TOTAL COST ITEM 6			$1,161,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 8 - TRANSPORTATION, TOOLS, SHOP AND WORK EQUIPMENT, OFFICE FURNITURE AND LABORATORY EQUIPMENT

		Total
1)	Maintenance Equipment, etc.	$ 280,000
2)	Administrative Equipment, etc.	30,000
3)	TOTAL COST ITEM 8	$ 310,000

Pacific Gas and Electric Company

CAPITAL COST ESTIMATE

296 Miles of Transmission Main

ITEM 9 - COMMUNICATIONS

		Total
1)	Mobile Radio in Vehicles	$ 15,000
2)	Base Radio Station - 4 @ $15,000 each	60,000
3)	Wire Line - Millville to Cottenwood - 25 Miles	50,000
4)	TOTAL COST ITEM 9	$ 125,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

SUMMARY

Item No.	Description	Total Cost
1	Land	$ 68,000
2	Rights of Way	2,328,000
3	Structures and Improvements	281,000
4	Transmission Main	83,867,000
5	Compressor Stations	5,736,000
6	Measurement and Regulation	1,210,000
7	Roads and Trails	130,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment	265,000
9	Communications	185,000
10	Total Direct Cost without Escalation	$ 94,070,000
11	Escalation	11,759,000
12	Total Direct Cost with Escalation	$105,829,000
13	Overhead	15,451,000
14	Corporate Organization Expense	1,420,000
15	Total Less Working Capital	$122,700,000
16	Working Capital	793,000
17	Total Project Cost	$123,493,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 1 - LAND

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Compressor Stations	Acre	120	500	$ 60,000
2)	Meter and Regulating Stations	Acre	4	500	2,000
3)	Miscellaneous Land	Acre	12	500	6,000
4)	TOTAL COST ITEM 1				$ 68,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 2 - RIGHTS OF WAY

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Survey	Mile	614	880	$ 540,200
2)	Acquisition	Mile	614	340	208,700
3)	Purchase Price	Mile	614	870	534,100
4)	Timber	Mile	217	4,816	1,045,000
5)		TOTAL COST ITEM 2			$ 2,328,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
PIPE - MAINLINE, f.o.b.mill				
1) 1 Mi.of 36" x.500 5LX52 Type "B" Construction	Ton	500	186.93	$ 93,500
2) 0.1 Mi.of 36" x.500 5LX52 Spec.Aerial Water Crossing	Ton	50	260.00	13,000
3) 19 Mi.of 36:x.422 5LX52 Type "A" Construction	Ton	8,044	191.36	1,539,200
4) 302.1 Mi.of 36"x.406 5LX52 Type "A" Construction	Ton	123,165	187.96	23,150,100
5) 80.6 Mi.of 36"x.391 5LX52 Type "A" Construction	Ton	31,562	191.70	6,050,400
6) 122 Mi.of 36"x.375 5LX52 Type "A" Construction	Ton	45,954	187.89	8,634,500
7) 88 Mi.of 36"x.344 5LX52 Type "A" Construction	Ton	30,411	195.00	5,930,100
8) 2.2 Mi.of 30"x.625 Gr.B Underwater Dual Crossings	Ton	1,133	194.16	220,000
9) 0.1 Mi.of 36"x.500 5LX46 Underwater Single Crossing	Ton	50	185.93	9,300
10) Total				$45,640,100
FREIGHT ON PIPE				
11) Freight	Ton	240,869	17.23	$ 4,150,200
PROTECTIVE COATING - including freight				
12) Primer	U.S.Gal.	63,360	.593	$ 37,600
13) Filled Enamel Asphalt	Ton	20,112	56.79	1,142,100
14) Inner Wrap	Square	344,380	.927	309,900
15) Outer Wrap	Square	351,980	1.75	615,200
16) Polyken Tape	Square	14,280	12.58	179,700
17) Felt Wrap	Square	16,800	1.74	29,300
18) Total				$ 2,313,800

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
HIGHWAY AND RAILROAD CROSSINGS				
1) 40"x.375 5LX42 Casing and Fittings	Foot	12,350	24.52	$ 302,800
CONCRETE WEIGHTS				
2) River 36" I.D.-7,100#	Each	1,655	173.03	286,400
3) Swamp 36" I.D.-7,100#	Each	3,240	173.03	560,600
4) Chance Anchors - 36"	Set	1,445	23.32	33,700
5) Total				$ 880,700
VALVES AND CONNECTIONS				
6) 36"x30" Mainline Plug Valves and Fittings	Each	23	25,996	$ 597,900
7) 30" Dual River Crossing Connection	Each	3	66,500	199,500
8) 36" Compressor Station Connection	Each	8	75,100	600,800
9) Mainline Meter Station Connections	Each	2	46,650	93,300
10) Manufactured Bends	Lot	--	--	78,600
11) Electrolysis Leads	Lot	--	--	10,200
12) Total				$ 1,580,300
MISCELLANEOUS MATERIALS				
13) Miscellaneous Materials	Lot	--	--	$ 476,700
WASHINGTON STATE TAX				
14) Pipe @ 3-1/3%				$ 393,200
15) Materials Other Than Pipe @ 3-1/3%				183,000
16) Total				$ 576,200
MAINLINE INSTALLATION				
17) Contract and Company Cost (614 Miles-3,241,920 feet)	Foot	--	8.62	$ 27,946,200
18) TOTAL COST ITEM 4				$ 83,867,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 5 - COMPRESSOR STATIONS

Station Location	Number of Compressors to be Installed (a)	Standard BHP to be Installed (b)	Cost Per BHP $ (c)	Total $ (d)
1) M.P. 309	3	10,500	273.14	$2,868,000
2) M.P. 555	3	10,500	273.14	2,868,000
3)		TOTAL COST ITEM 5		$5,736,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 6 - MEASUREMENT AND REGULATION

	Unit (a)	Quantity (b)	Total (c)
1) California-Oregon Border Meter Station	Each	1	$ 174,600
2) Canada-U.S. Border Meter Station	Each	1	174,600
3) Pressure Limiting Stations, complete	Each	4	463,200
4) Pressure Limiting Stations, skeleton	Each	6	397,600
5) TOTAL COST ITEM 6			$ 1,210,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 8 - TRANSPORTATION, TOOLS, SHOP AND WORK EQUIPMENT, OFFICE FURNITURE AND LABORATORY EQUIPMENT

		Total
1)	Maintenance Equipment, etc.	$ 238,000
2)	Administrative Equipment, etc.	27,000
3)	TOTAL COST ITEM 8	$ 265,000

Pacific Gas Transmission Company

CAPITAL COST ESTIMATE

614 Miles of Transmission Main

ITEM 9 - COMMUNICATIONS

		Total
1)	Mobile Radio in Vehicles	$ 35,000
2)	Base Radio Station - 8 @ $15,000 each	120,000
3)	Wire Line	30,000
4)	TOTAL COST ITEM 9	$185,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

SUMMARY

Item No.	Description	Total Cost
1	Land	$ 6,000
2	Rights of Way	462,000
3	Structures and Improvements	67,000
4	Transmission Main	23,451,000
5	Compressor Station	3,317,000
6	Measurement and Regulation	637,000
7	Roads and Trails	100,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment	130,000
9	Communications	80,000
10	Total Direct Cost without Escalation	$28,250,000
11	Escalation	3,531,000
12	Total Direct Cost with Escalation	$31,781,000
13	Overhead	5,435,000
14	Corporate Organization Expense	710,000
15	Total Less Working Capital	$37,926,000
16	Working Capital	238,000
17	Total Project Cost	$38,164,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 1 - LAND

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Compressor Station	Acre	15	250	$ 3,800
2)	Meter and Regulating Stations	Acre	5	250	1,200
3)	Miscellaneous Land	Acre	4	250	1,000
4)	TOTAL COST ITEM 1				$ 6,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 2 - RIGHTS OF WAY

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Survey	Mile	118	750	$ 88,500
2)	Acquisition	Mile	118	150	17,700
3)	Purchase Price	Mile	118	303	35,800
4)	Timber	Mile	80	4,000	320,000
5)		TOTAL COST ITEM 2			$462,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
PIPE - MAINLINE, f.o.b. mill				
1) 1.6 Mi.of 36" x.750 5LX42 Type "C" Construction	Ton	1,183	210.40	$ 248,900
2) 0.4 Mi.of 36"x.500 5LX52 Type "B" Construction	Ton	200	186.93	37,400
3) 25.4 Mi.of 36"x.438 5LX52 Type "A" Construction	Ton	11,143	187.92	2,094,000
4) 36.4 Mi.of 36"x.422 5LX52 Type "A" Construction	Ton	15,411	191.36	2,949,000
5) 54 Mi.of 36"x.406 5LX52 Type "A" Construction	Ton	22,016	187.96	4,138,100
6) 0.4 Mi.of 30"x.625 Gr.B Underwater Dual Crossing	Ton	206	200.00	41,200
7) Total				$9,508,600
FREIGHT ON PIPE				
8) Freight	Ton	50,159	32.15	$1,612,600
PROTECTIVE COATING - including freight				
9) Primer	U.S.Gal.	11,990	.592	$ 7,100
10) Filled Enamel Asphalt	Ton	3,810	63.33	241,300
11) Inner Wrap	Square	63,270	.906	57,300
12) Outer Wrap	Square	66,600	1.77	117,900
13) Polyken Tape	Square	3,570	13.00	46,400
14) Felt Wrap	Square	4,200	1.76	7,400
15) Total				$ 477,400
HIGHWAY AND RAILROAD CROSSINGS				
16) 40"x.375 5LX42 Casing and Fittings	Foot	6,375	25.00	$ 159,400

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
CONCRETE WEIGHTS				
1) River 36" I.D.-7,100#	Each	1,265	177.50	$ 224,500
2) Swamp 36" I.D.-7,100#	Each	2,346	177.50	416,500
3) Chance Anchors - 36"	Set	45	24.06	1,100
4) Total				$ 642,100
VALVES AND CONNECTIONS				
5) 36"x30" Mainline Plug Valves and Fittings	Each	5	26,840	$ 134,200
6) 30" Dual River Crossing Connection	Each	1	68,700	68,700
7) 36" Compressor Station Connection	Each	2	89,050	178,100
8) Mainline Meter Station Connection	Each	2	48,800	97,600
9) Manufactured Bends	Lot	--	--	24,400
10) Electrolysis Leads	Lot	--	--	2,000
11) Total				$ 505,000
MISCELLANEOUS MATERIALS				
12) Miscellaneous Materials	Lot	--	--	$ 128,600
CANADIAN DUTY AND TAX				
13) Pipe and pipe freight @ 15% Duty, 10% Dominion Tax, and 5% Provincial Tax				$3,460,400
14) Materials Other Than Pipe @ 22-1/2% Duty, 10% Dominion Tax and 5% Provincial Tax				473,500
15) Total				$3,933,900

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
MAINLINE INSTALLATION				
1) Contract and Company Cost (118 Miles-623,040 Feet)	Foot	--	10.41	$ 6,483,400
2)	TOTAL COST ITEM 4			$23,451,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 5 - COMPRESSOR STATION

Station Location	Number of Compressors to be Installed (a)	Standard BHP to be Installed (b)	Cost Per BHP $ (c)	Total $ (d)
1) M.P. 1025	3	10,500	315.90	$3,317,000
2)		TOTAL COST ITEM 5		$3,317,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 6 - MEASUREMENT AND REGULATION

	Unit (a)	Quantity (b)	Total (c)
1) Alberta-British Columbia Border Meter Station	Each	1	$ 256,600
2) Canada-U.S. Border Meter Station	Each	1	225,000
3) Pressure Limiting Station, complete	Each	1	155,400
4) Pressure Limiting Station, skeleton	-	-	--
5) TOTAL COST ITEM 6			$ 637,000

S & M Pipeline Limited

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 8 - TRANSPORTATION, TOOLS, SHOP AND WORK EQUIPMENT, OFFICE FURNITURE AND LABORATORY EQUIPMENT

		Total
1)	Maintenance Equipment, etc.	$ 117,000
2)	Administrative Equipment, etc.	13,000
3)	TOTAL COST ITEM 8	$ 130,000

S & M PIPELINE LIMITED

CAPITAL COST ESTIMATE

118 Miles of Transmission Main

ITEM 9 - COMMUNICATIONS

		Total
1)	Mobile Radio in Vehicles	$ 12,000
2)	Base Radio Station - 3 @ $15,000 each	45,000
3)	Wire Line	23,000
4)	TOTAL COST ITEM 9	$ 80,000

10/8/57

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main
145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

SUMMARY

Item No.	Description	Total Cost
1	Land	$ 30,000
2	Rights of Way	881,000
3	Structures and Improvements	320,000
4	Transmission Main	69,597,000
5	Compressor Stations	--
6	Measurement and Regulation	288,000
7	Roads and Trails	305,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment	225,000
9	Communications	198,000
10	Total Direct Cost without Escalation	$ 71,844,000
11	Escalation	8,981,000
12	Total Direct Cost with Escalation	$ 80,825,000
13	Overhead	14,710,000
14	Total Less Working Capital	$ 95,535,000
15	Working Capital	500,000
16	Total Project Cost	$ 96,035,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

SUMMARY

Item No.	Description		Total Cost
1	Land	$	25,000
2	Rights of Way		596,000
3	Structures and Improvements		270,000
4	Transmission Main		60,675,000
5	Compressor Stations		--
6	Measurement and Regulation		--
7	Roads and Trails		220,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment		155,000
9	Communications		152,000
10	Total Direct Cost without Escalation	$	62,093,000
11	Escalation		7,762,000
12	Total Direct Cost with Escalation	$	69,855,000
13	Overhead		14,710,000
14	Total Less Working Capital	$	84,565,000
15	Working Capital		500,000
16	Total Project Cost	$	85,065,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 1 - LAND

		Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Compressor Station	Acre	80	250	$20,000
2)	Meter and Regulating Stations	Acre	-	-	-
3)	Miscellaneous Land	Acre	20	250	5,000
4)		TOTAL COST ITEM 1			$25,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 2 - RIGHTS OF WAY

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Survey	Mile	362	750	$ 271,500
2)	Acquisition	Mile	362	150	54,300
3)	Purchase Price	Mile	362	303	109,700
4)	Timber	Mile	40	4,012	160,500
5)		TOTAL COST ITEM 2			$ 596,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
PIPE - MAINLINE, f.o.b.mill				
1) 241.3 Mi.of 36"x.406 5LX52 Type "A" Construction	Ton	98,377	187.96	$18,491,100
2) 0.1 Mi.of 36"x.500 5LX52 Spec.Construction-Aerial Water Crossing	Ton	50	260.00	13,000
3) 0.6 Mi.of 36"x.500 5LX46 Underwater Single Crossing	Ton	300	184.93	55,500
4) 120 Mi.of 30"x.375 5LX52 Type "A" Construction	Ton	37,588	183.92	6,913,400
5) Total				$25,473,000
FREIGHT ON PIPE				
6) Freight	Ton	136,315	43.39	$ 5,914,800
PROTECTIVE COATING - including freight				
7) Primer	U.S.Gal.	35,900	.588	$ 21,100
8) Filled Enamel Asphalt	Ton	11,400	62.26	709,800
9) Inner Wrap	Square	189,300	.905	171,300
10) Outer Wrap	Square	199,300	1.77	352,800
11) Polyken Tape	Square	5,060	13.00	65,800
12) Felt Wrap	Square	5,950	1.76	10,500
13) Total				$ 1,331,300
HIGHWAY AND RAILROAD CROSSINGS				
14) 40"x.375 5LX42 Casing and Fittings	Foot	4,625	26.40	$ 122,100
15) 34"x.375 5LX42 Casing and Fittings	Foot	375	20.00	7,500
16) Total				$ 129,600

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
CONCRETE WEIGHTS				
1) River 36" I.D.-7,100#	Each	2,220	177.52	$ 394,100
2) River 30" I.D.-6,200#	Each	475	155.00	73,600
3) Chance Anchors - 36"	Set	900	24.33	21,900
4) Total				$ 489,600
VALVES AND CONNECTIONS				
5) 36"x30" Mainline Plug Valves and Fittings	Each	11	26,955	$ 296,500
6) 30"x30" Mainline Plug Valves and Fittings	Each	5	22,660	113,300
7) 36" Single River Crossing Connection	Each	1	59,000	59,000
8) 36" Compressor Station Connection	Each	2	93,500	187,000
9) 30" Compressor Station Connection	Each	1	89,600	89,600
10) Manufactured Bends	Lot	1	--	43,500
11) Electrolysis Leads	Lot	1	--	6,300
12) Total				$ 795,200
MISCELLANEOUS MATERIALS				
13) Miscellaneous Materials	Lot	1		$ 341,100
CANADIAN DUTY AND TAX				
14) Pipe and Pipe Freight @ 15% Duty and 10% Dominion Tax				$7,508,900
15) Materials Other Than Pipe @ 22-1/2% Duty and 10% Dominion Tax				528,800
16) Total				$8,037,700

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
MAINLINE INSTALLATION				
1) Contract and Company Cost 36" (242 Miles-1,277,760 ft)	Foot	-	8.65	$ 11,051,000
2) Contract and Company Cost 30" (120 Miles-633,600 ft)	Foot	-	11.22	7,111,700
3) Total				$ 18,162,700
4) TOTAL COST ITEM 4				$ 60,675,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 8 - TRANSPORTATION, TOOLS, SHOP AND WORK EQUIPMENT, OFFICE FURNITURE AND LABORATORY EQUIPMENT

		Total
1)	Maintenance Equipment, etc.	$ 119,000
2)	Administrative Equipment, etc.	36,000
3)	TOTAL COST ITEM 8	$ 155,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

362 Miles of Transmission Main

ITEM 9 - COMMUNICATIONS

		Total
1)	Mobile Radio in Vehicles	$ 37,000
2)	Base Radio Station - 3 @ $15,000 each	45,000
3)	Wire Line	70,000
4)	TOTAL COST ITEM 9	$ 152,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

SUMMARY

Item No.	Description	Total Cost
1	Land	$ 5,000
2	Rights of Way	285,000
3	Structures and Improvements	50,000
4	Transmission Main	8,922,000
5	Compressor Stations	--
6	Measurement and Regulation	288,000
7	Roads and Trails	85,000
8	Transportation, Tools, Shop and Work Equipment, Office Furniture and Laboratory Equipment	70,000
9	Communications	46,000
10	Total Direct Cost without Escalation	$ 9,751,000
11	Escalation	1,219,000
12	Total Direct Cost with Escalation	$10,970,000
13	Overhead)	
14	Total Less Working Capital)	These Items are included in the 362 Miles of Transmission Main, Page 35
15	Working Capital)	
16	Total Project Cost)	

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The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 1 - LAND

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Compressor Station	Acre	-	-	$ --
2)	Meter and Regulating Stations	Acre	13	250	$3,200
3)	Miscellaneous Land	Acre	7	250	1,800
4)		TOTAL COST ITEM 1			$5,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

121 Miles of Receiving Laterals

42 Miles of Delivery Laterals

ITEM 2 - RIGHTS OF WAY

	Item	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
1)	Survey	Mile	187	750	$140,300
2)	Acquisition	Mile	187	150	28,000
3)	Purchase Price	Mile	187	303	56,700
4)	Timber	Mile	15	4,000	60,000
5)		TOTAL COST ITEM 2			$285,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals

42 Miles of Delivery Laterals

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
PIPE - MAINLINE, f.o.b.mill				
1) 89.5 Mi.of 16"x.250 5LX42 Type "A" Construction	Ton	9,935	191.77	$1,905,200
2) 47.5 Mi.of 14"x.250 5LX42 Type "A" Construction	Ton	4,603	190.95	878,900
3) 46.0 Mi.of 8-5/8"x.250 5L Gr.B-Type "A" Construction	Ton	2,715	178.01	483,300
4) 4 Mi.of 6-5/8"x.250 5L Gr.B-Type "A" Construction	Ton	180	181.79	32,700
5) Total				$3,300,100
FREIGHT ON PIPE				
6) Freight	Ton	17,433	43.54	$ 759,000
PROTECTIVE COATING - including freight				
7) Primer	U.S.Gal.	7,570	.588	$ 4,500
8) Filled Enamel Asphalt	Ton	1,800	62.26	112,100
9) Inner Wrap	Square	38,170	.905	34,500
10) Outer Wrap	Square	40,110	1.77	71,000
11) Total				$ 222,100
HIGHWAY AND RAILROAD CROSSINGS				
12) 20" x.375 5LX42 Casing and Fittings	Foot	1,125	10.70	$ 12,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)		Total (d)
CONCRETE WEIGHTS					
1) River 16" I.D.-2,000#	Each	280	50.00	$	14,000
2) River 14" I.D.-2,000#	Each	160	50.00		8,000
3) Total				$	22,000
VALVES AND CONNECTIONS					
4) 16"x16" Mainline Plug Valves and Fittings	Each	4	7,400	$	29,600
5) 14"x14" Mainline Plug Valves and Fittings	Each	2	5,100		10,200
6) 8"x8" Mainline Plug Valves and Fittings	Each	1	1,900		1,900
7) Field Meter Station Connections	Lot	1			51,500
8) Purchase Taps	Lot	1			68,100
9) Total				$	161,300
MISCELLANEOUS MATERIALS					
10) Miscellaneous Materials	Lot	1		$	45,300
CANADIAN DUTY AND TAX					
11) Pipe and Pipe Freight @ 22-1/2% Duty and 10% Dominion Tax				$	1,275,800
12) Materials Other Than Pipe @ 22-1/2% Duty and 10% Dominion Tax					85,400
13) Total				$	1,361,200

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 4 - TRANSMISSION MAIN

	Unit (a)	Quantity (b)	Unit Cost (c)	Total (d)
MAINLINE INSTALLATION				
1) Contract and Company Cost 16" (89.5 Mi.-472,560 feet)	Foot	-	3.60	$ 1,701,200
2) Contract and Company Cost 14" (47.5 Mi.-250,800 feet)	Foot	-	3.25	815,100
3) Contract and Company Cost 8" (46 Mi.-242,880 feet)	Foot	-	2.00	485,700
4) Contract and Company Cost 6" (4 Mi.-21,120 feet)	Foot	-	1.75	37,000
5) Total				$ 3,039,000
6) TOTAL COST ITEM 4				$ 8,922,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 6 - MEASUREMENT AND REGULATION

	Unit (a)	Quantity (b)	Total (c)
1) Waterton Field Meter Station	Each	1	$ 21,100
2) Castle River Field Meter Station	Each	1	21,100
3) Sarcee Field Meter Station	Each	1	27,200
4) Crossfield Field Meter Station	Each	1	27,200
5) Alhambra Field Meter Station	Each	1	27,000
6) Homeglen-Rimbey Field Meter Station	Each	1	14,200
7) Westerose South Field Meter Station	Each	1	45,500
8) Buck Lake Field Meter Station	Each	1	14,200
9) Pembina Field Meter Station	Each	1	27,200
10) Windfall Field Meter Station	Each	1	21,100
11) Virginia Hills Field Meter Station	Each	1	21,100
12) Pine Creek Field Meter Station	Each	1	21,100
13) TOTAL COST ITEM 6			$ 288,000

The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 8 - TRANSPORTATION, TOOLS, SHOP AND WORK EQUIPMENT, OFFICE FURNITURE AND LABORATORY EQUIPMENT

		Total
1)	Maintenance Equipment, etc.	$ 60,000
2)	Administrative Equipment, etc.	10,000
3)	TOTAL COST ITEM 8	$ 70,000

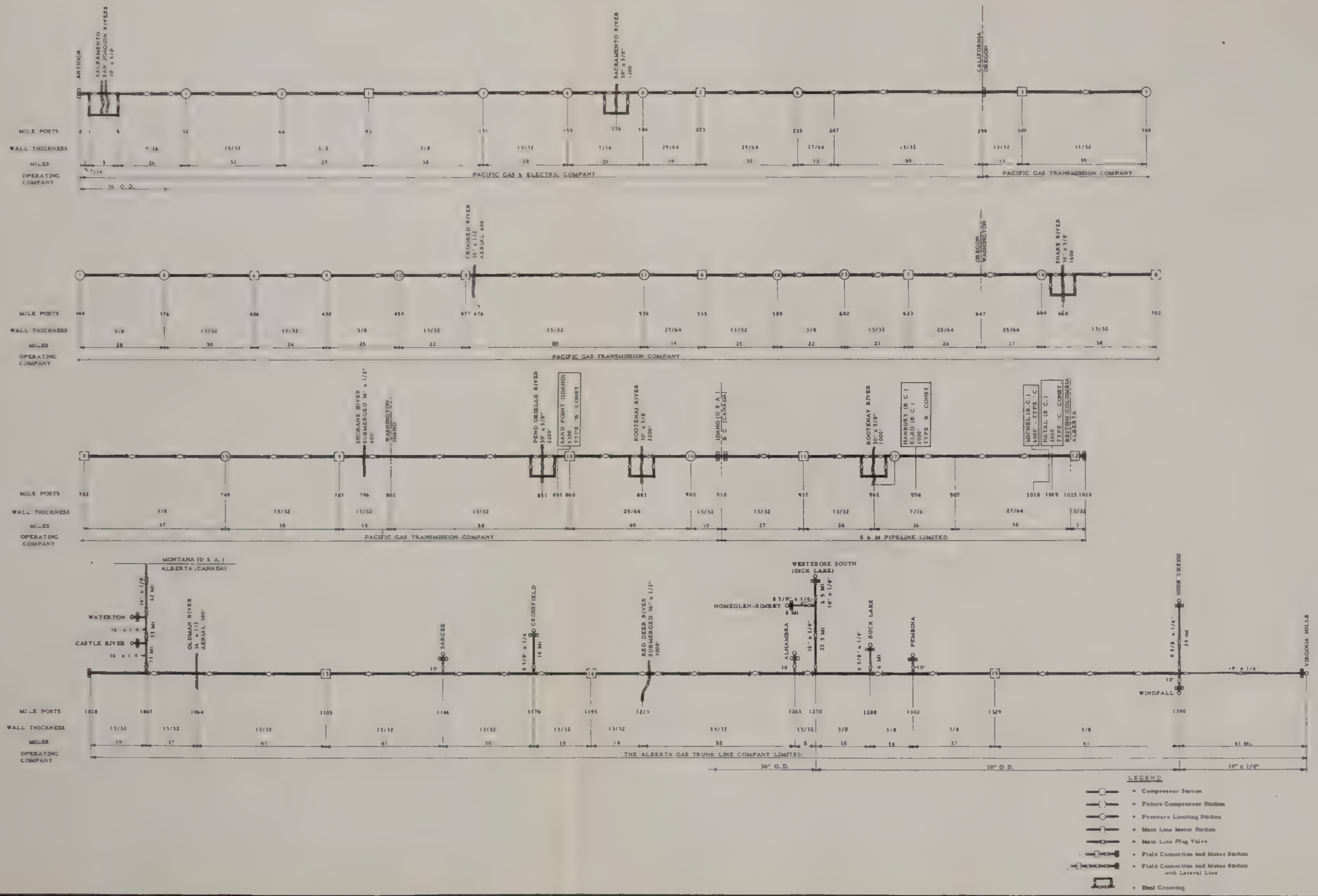
The Alberta Gas Trunk Line Company Limited

CAPITAL COST ESTIMATE

145 Miles of Receiving Laterals
42 Miles of Delivery Laterals

ITEM 9 - COMMUNICATIONS

		Total
1)	Mobile Radio in Vehicles	$ 20,000
2)	Base Radio Station	--
3)	Wire Line	26,000
4)	TOTAL COST ITEM 9	$ 46,000



SUMMARY OF FACILITIES

LINE PIPE

	ITEM (a)	OD INCHES (b)	WALL INCHES (c)	SPECIFICATION (d)	MILES OF PIPE #1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL MILES (i)	TOTAL TONS (j)
1	TYPE C CONSTRUCTION	36	[illegible]	API 5LX42		-	.6	-	[illegible]	83
2	TYPE B CONSTRUCTION	36	[illegible]	API 5LX52		1.0	0.4	-	1.4	100
3	TYPE A CONSTRUCTION	36	[illegible]	API 5LX52	29.0	-		-	29.0	[illegible]
4	TYPE A CONSTRUCTION	36	15/32	API 5LX52	32.0	-	-	-	32.0	[illegible]
5	TYPE A CONSTRUCTION	36	29/64	API 5LX52	19.0			-	19.0	[illegible]
6	TYPE A CONSTRUCTION	36	7/16	API 5LX52	51.8	-	25.4		77.2	[illegible]
7	TYPE A CONSTRUCTION	36	27/64	API 5LX52	12.0	19.0	36.4	-	67.4	[illegible]
8	TYPE A CONSTRUCTION	36	13/32	API 5LX52	77.0	302	54.0	241.5	674.4	[illegible]
9	TYPE A CONSTRUCTION	36	25/64	API 5LX52	32.0	80.6			112.6	[illegible]
10	TYPE A CONSTRUCTION	36	3/8	API 5LX52	38.0	122.0	-		160.0	[illegible]
11	TYPE A CONSTRUCTION	36	[illegible]	API 5LX52		88.0	-	-	88.0	[illegible]
12	TYPE A CONSTRUCTION	30	3/8	API 5LX52	-			120.0	120.0	[illegible]
13	AERIAL WATER CROSSINGS	36	1/2	API 5LX52*	-	0.1		0.1	0.2	[illegible]
14	UNDERWATER SINGLE XINGS	36	1/2	API 5LX46		0.1		0.6	0.7	350
15	UNDERWATER DUAL XINGS	36	5/8	API 5L Gr B	10.5	2.2	0.4	-	13.1	[illegible]
16	TYPE A CONSTRUCTION	16	[illegible]	API 5LX42		-		89.5	89.5	[illegible]
17	TYPE A CONSTRUCTION	16	[illegible]	API 5LX42				67.5	67.5	[illegible]
18	TYPE A CONSTRUCTION	8 5/8	[illegible]	API 5L Gr B		-	-	46.0	46.0	[illegible]
19	TYPE A CONSTRUCTION	6 5/8	1/4	API 5L Gr B	-			6.0	6.0	[illegible]
20										
21										
				*ALUMINUM KILLED						

CASING PIPE

		ITEM (a)	OD (b)	WALL (c)	SPECIFICATION (d)	FEET OF PIPE #1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL FEET	TOTAL TONS
22	36	LINE PIPE CROSSING	40	3/8	API 5LX42	8,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	30	LINE PIPE CROSSING	34	3/8	API 5LX42	-	-	-	375	375	23
24	16	LINE PIPE CROSSING	20	3/8	API 5LX42	-			[illegible]	[illegible]	[illegible]
25											
26											

LINE PLUG VALVES

	ITEM (a)	SIZE INCHES (c)	SPECIFICATION (d)	NUMBER OF VALVES #1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL (i)
27	MAINLINE INSTALLATIONS	36x12	ASA SERIES 600	11	23	5	11	50
28	MAINLINE INSTALLATIONS	36x10	ASA SERIES [illegible]	6				6
29	MAINLINE INSTALLATIONS	30x30	ASA SERIES 600	-	-	-	5	5
30	RECEIVING LATERAL INSTALLATIONS AND	[illegible]	ASA SERIES 600			-	6	6
31	MAINLINE PURCHASE CONNECTIONS	6x4	ASA SERIES 600	-	-	-	3	3
32		10x8	ASA SERIES 600	-	-	-	4	4
33		8x8	ASA SERIES 600			-	4	4
34		6x6	ASA SERIES 600	-	-	-		1
35								

SWAMP AND RIVER WEIGHTS AND CONTINUOUS COATING

	TYPE OF WEIGHT (a)	OD INCHES (c)	SIZE OF WEIGHT (d)	NUMBER OF WEIGHTS #1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL (i)
36	CONCRETE RIVER AND SWAMP WEIGHTS	36	7,000	[illegible]	[illegible]	[illegible]	2,220	[illegible]
37	CONCRETE RIVER AND SWAMP WEIGHTS	30	12000	-	-	-	475	475
38	CONCRETE RIVER AND SWAMP WEIGHTS	16	20000		-		280	280
39	CONCRETE RIVER AND SWAMP WEIGHTS	14	25000		-	-	160	160
40				-	-	-		
41								
			COATING THICKNESS INCHES	MILES OF COATING				
42	CONT CONCRETE COATING FOR SWAMP	36	4.75	-	-		36.0	36.0
43	CONT CONCRETE COATING FOR SWAMP	30	3.75	-	-	-	49.2	49.2
44	CONT CONCRETE COATING FOR SWAMP	16	1.25				7.5	7.5
45	CONT CONCRETE COATING FOR SWAMP	8	1.25			-	18.5	18.5
46	CONT CONCRETE COATING FOR SWAMP	6	1.00			-	14.5	14.5
47								
48								

COAT AND WRAP MATERIALS

	ITEM (a)	UNITS (d)	#1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL (i)
49	PRIMER	U S GALS	31,530	63,360	[illegible]	43,470	150,350
50	FILLED ENAMEL ASPHALT	TONS	[illegible]	[illegible]	[illegible]	[illegible]	47,043
51	INNER WRAP	SQUARES	[illegible]	334,380	[illegible]	227,475	[illegible]
52	OUTER WRAP	SQUARES	175,220	[illegible]	[illegible]	[illegible]	[illegible]
53	POLYKEN TAPE	SQUARES	2,570	16,200	2,570	5,060	26,400
54	FELT WRAP	SQUARES	6,200	16,800	6,200	5,950	31,150
55							

OTHER ITEMS

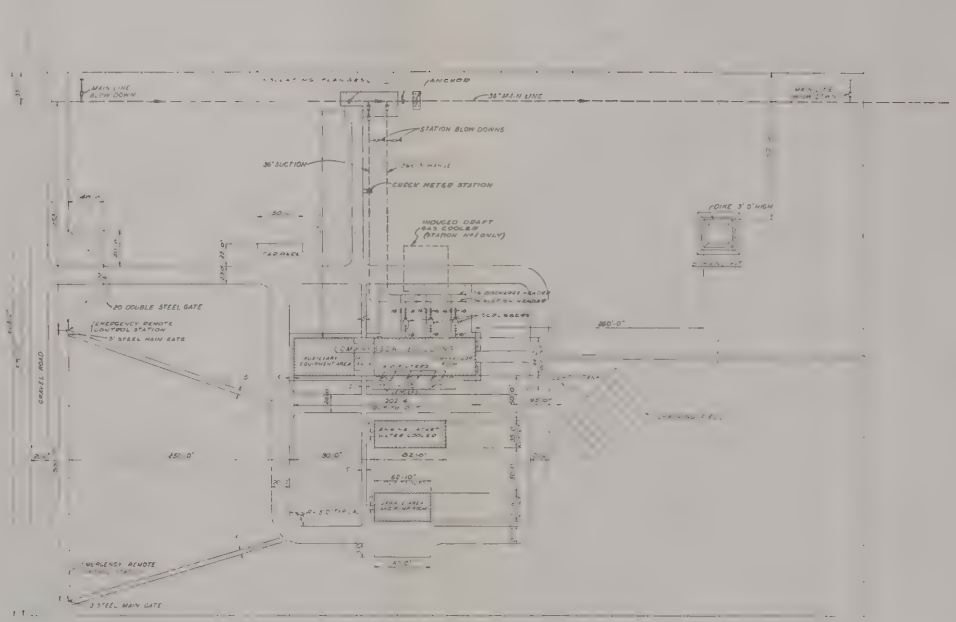
	ITEM (a)	UNITS (d)	#1 (e)	#2 (f)	#3 (g)	#4 (h)	TOTAL (i)
56	COMPRESSOR STATION CONNECTIONS	NUMBER	2	[illegible]	2	3	[illegible]
57	COMPRESSOR STATIONS	NUMBER	1	2	1	-	4
58	MAINLINE METER STATION CONNECTIONS	NUMBER		2	2		4
59	MAINLINE METER STATIONS	NUMBER		2	2	-	4
60	PRESSURE LIMITING STATION	NUMBER	6	10	1	-	17
61	FIELD METER STATION CONNECTIONS	NUMBER	-	-	-	12	12
62	FIELD METER STATIONS	NUMBER	-	-	-	12	12
63	TERMINAL METER STATION CONNECTION	NUMBER	1			-	1
64	TERMINAL METER STATION	NUMBER	1	-	-	-	1
65	SINGLE RIVER CROSSINGS	NUMBER	-	1	-	1	2
66	DUAL RIVER CROSSINGS	NUMBER	2	3	1	-	6
67	AERIAL BRIDGE CROSSINGS	NUMBER	-	1	-	1	2
68							

#1 PACIFIC GAS AND ELECTRIC COMPANY
#2 PACIFIC GAS TRANSMISSION COMPANY
#3 S & M PIPELINE LIMITED
#4 THE ALBERTA GAS TRUNK LINE COMPANY LIMITED

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA - CALIFORNIA PROJECT FACILITIES DIAGRAM

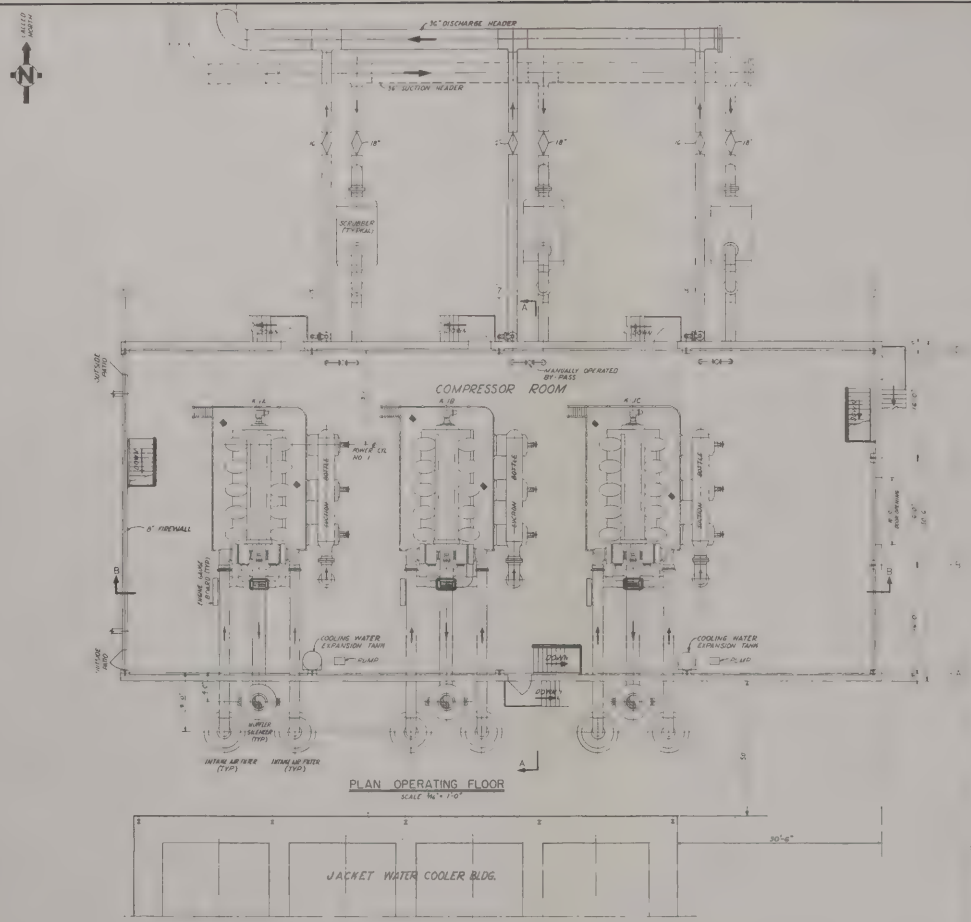
October 17, 1957



PLOT PLAN

GRAPHIC SCALE - FEET

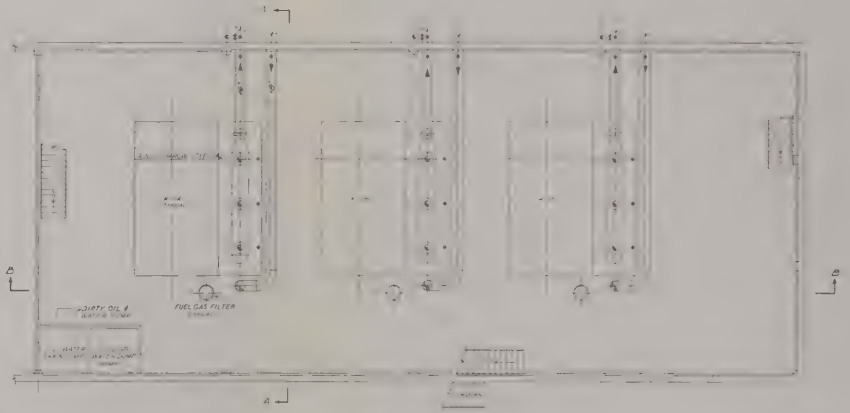
BECHTEL CORPORATION SAN FRANCISCO
ALBERTA - CALIFORNIA PROJECT
PLOT PLAN COMPRESSOR STATION



PLAN OPERATING FLOOR
SCALE 1/4" = 1'-0"

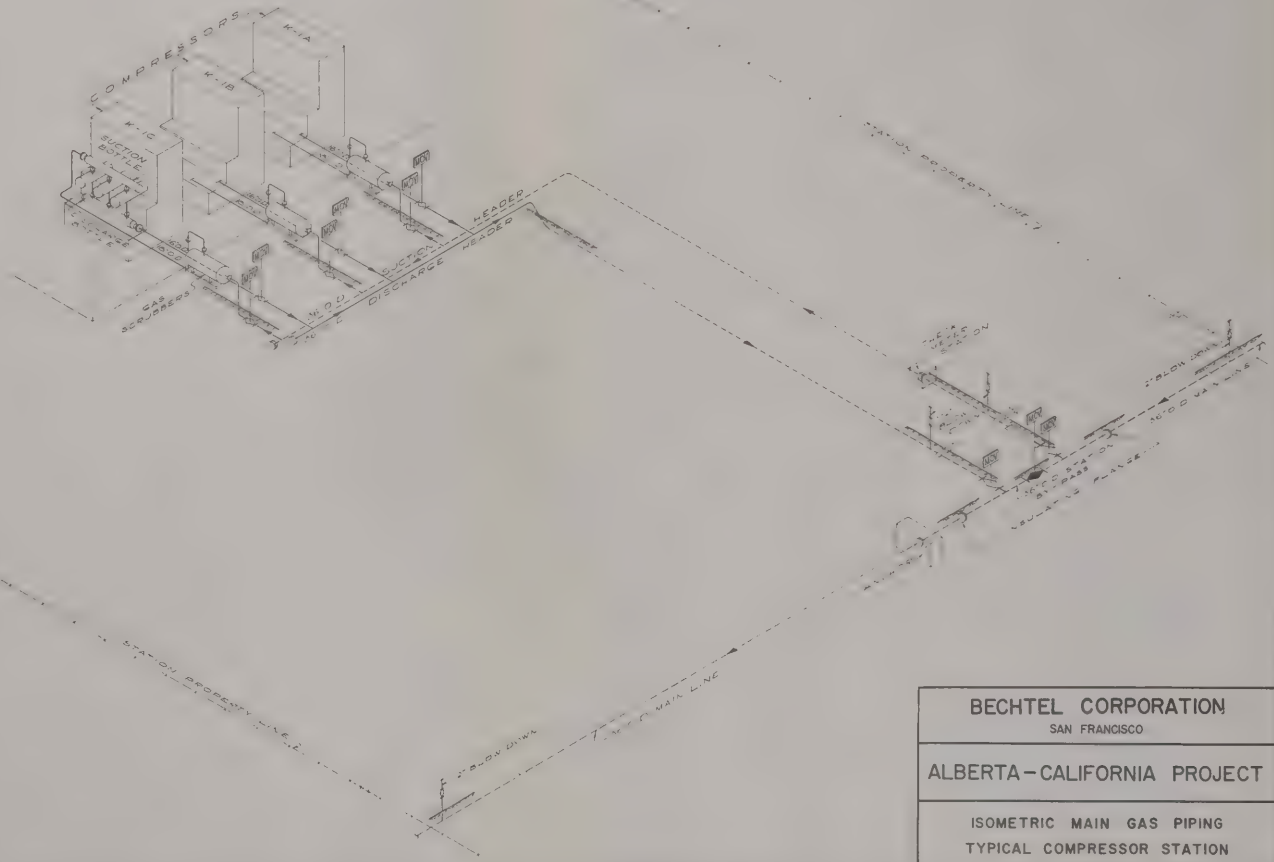
BECHTEL CORPORATION SAN FRANCISCO
ALBERTA – CALIFORNIA PROJECT
EQUIPMENT ARRANGEMENT PLAN OPERATING FLOOR COMPRESSOR STATION

October 8, 1957



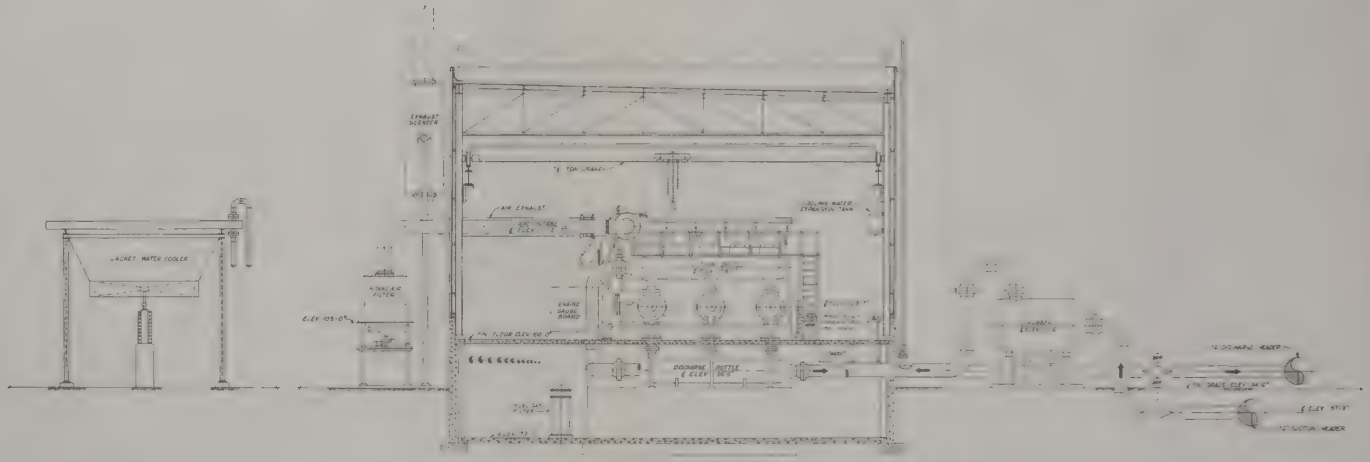
BECHTEL CORPORATION SAN FRANCISCO
ALBERTA – CALIFORNIA PROJECT
EQUIPMENT ARRANGEMENT PLAN BASEMENT COMPRESSOR STATION

October 8, 1957



BECHTEL CORPORATION SAN FRANCISCO
ALBERTA – CALIFORNIA PROJECT
ISOMETRIC MAIN GAS PIPING TYPICAL COMPRESSOR STATION

October 8, 1957



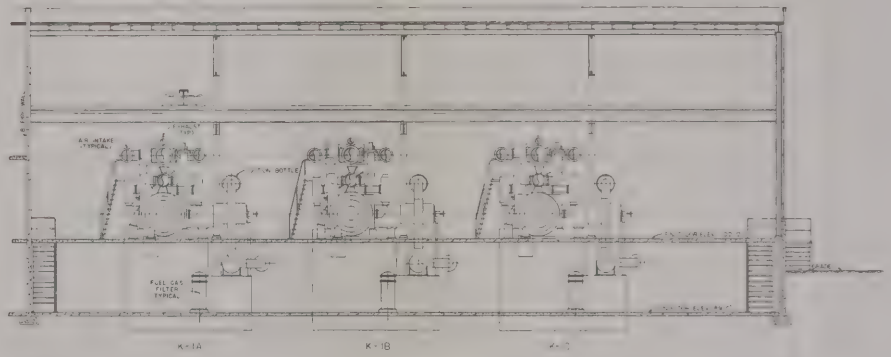
SECTION "A-A"
(SCALE 1/4"=1'-0")

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA - CALIFORNIA PROJECT

EQUIPMENT ARRANGEMENT
COMPRESSOR WING SECTION "A-A"
COMPRESSOR STATION

October 8, 1957



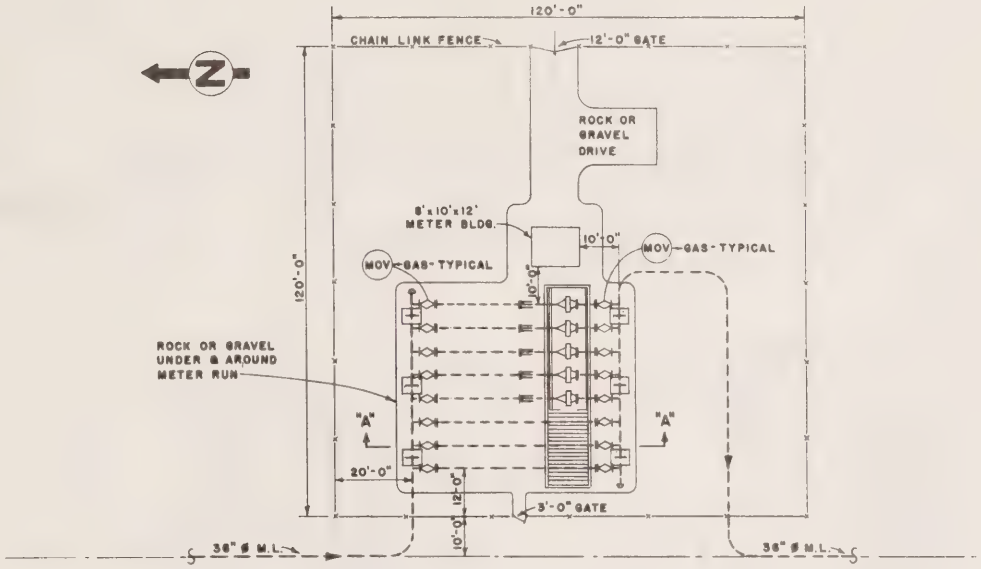
SECTION "B-B"

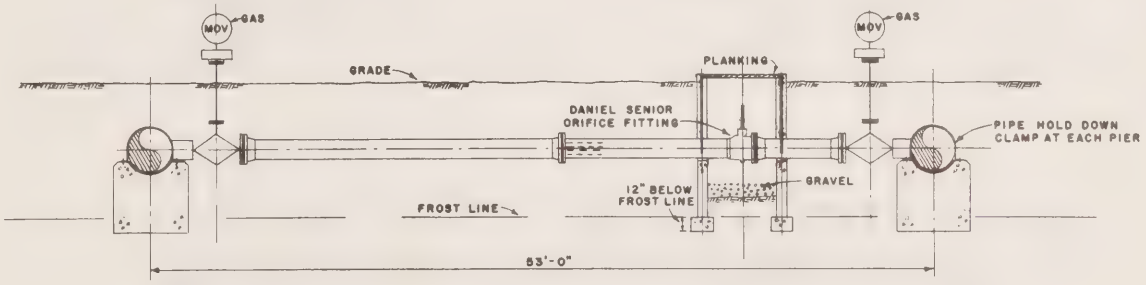
BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA-CALIFORNIA PROJECT

EQUIPMENT ARRANGEMENT
COMPRESSOR WING SECTION "B-B"
COMPRESSOR STATION

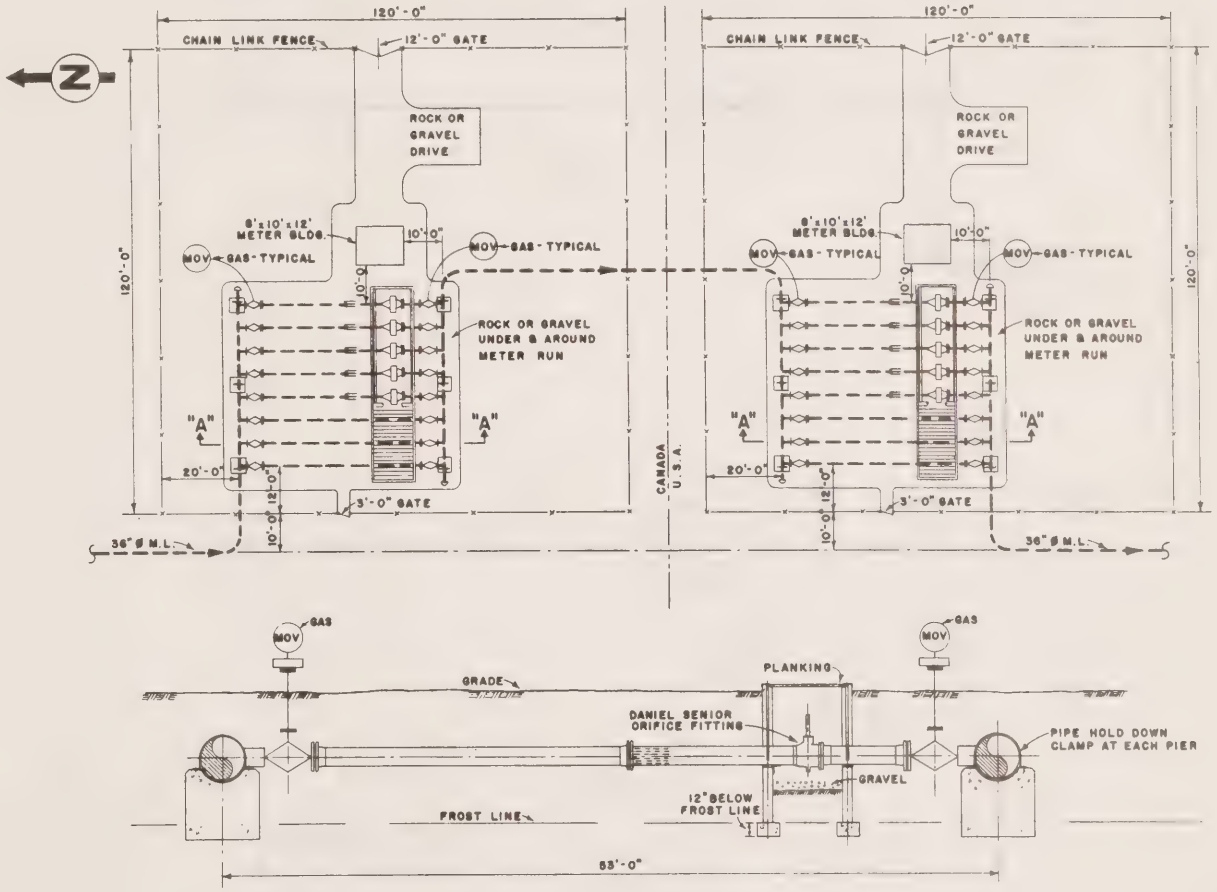
October 8, 1957





SECTION "A"-"A"

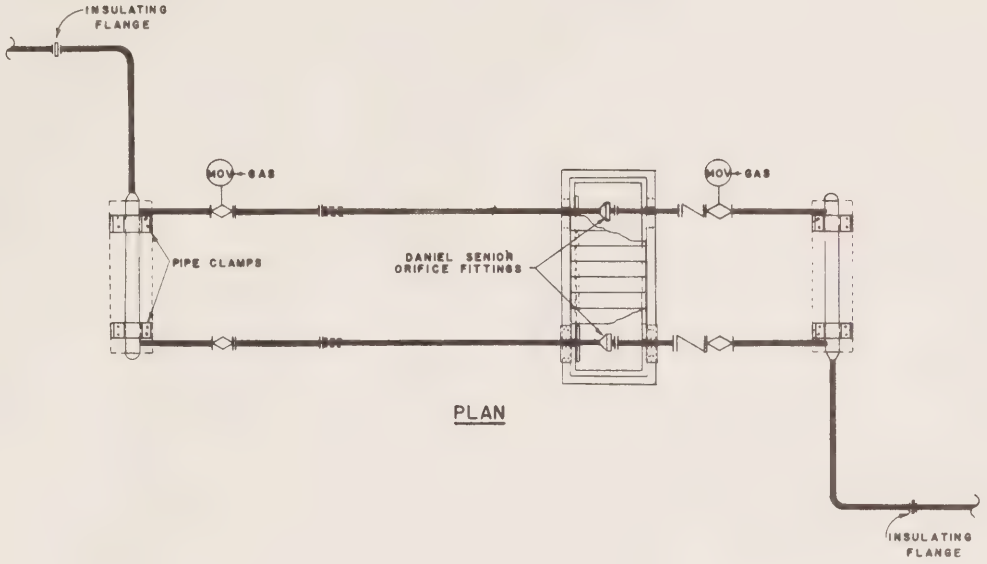
BECHTEL CORPORATION SAN FRANCISCO
ALBERTA-CALIFORNIA PROJECT
PLOT PLAN MAIN LINE METER STATION



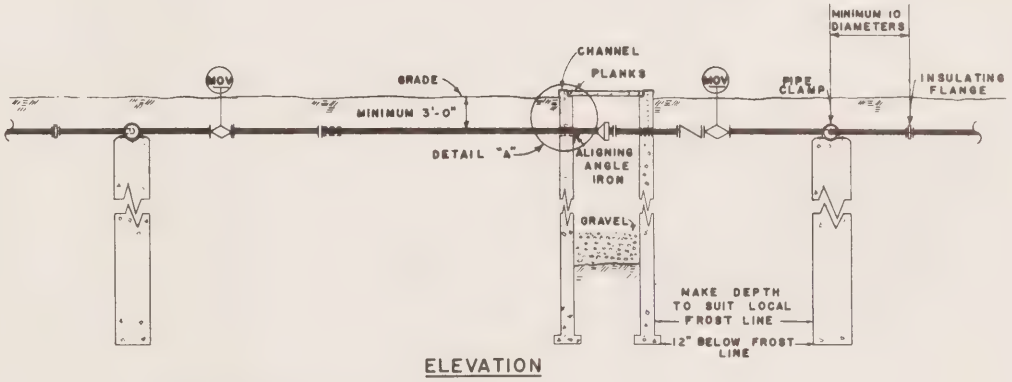
SECTION "A"-"A"

BECHTEL CORPORATION SAN FRANCISCO
ALBERTA – CALIFORNIA PROJECT
PLOT PLAN MAIN LINE METER STATION AT INTERNATIONAL BORDER

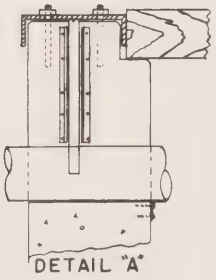
October 8, 1957



PLAN

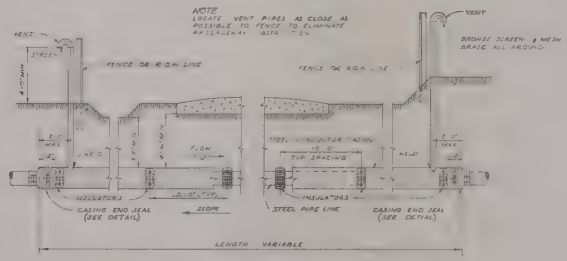


ELEVATION

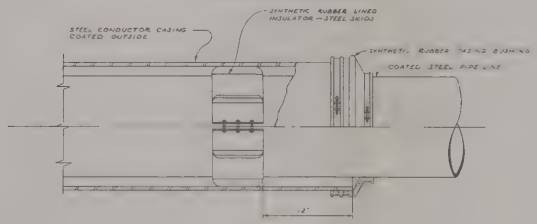


DETAIL "A"

BECHTEL CORPORATION SAN FRANCISCO
ALBERTA – CALIFORNIA PROJECT
TYPICAL PURCHASE METER STATION



TYPICAL CROSS SECTION



CASING SEAL DETAIL

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA – CALIFORNIA PROJECT

HIGHWAY CROSSING
OIL OR GAS TRANSMISSION LINES

October 8, 1957

NOTES

1 - COATING AND PAINTING

ALL BELOW GROUND METAL SURFACES SHALL BE FLOOD COATED TO THE SAME SPECIFICATIONS AS ON THE PIPELINE.

ALL ABOVE GROUND METAL SURFACES SHALL BE THOROUGHLY CLEANED AND PRIMED WITH ONE COAT OF RED LEAD.

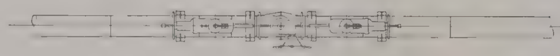
TWO COATS OF PAINT SHALL BE APPLIED AS FOLLOWS:

HANDWHEELS — BLACK

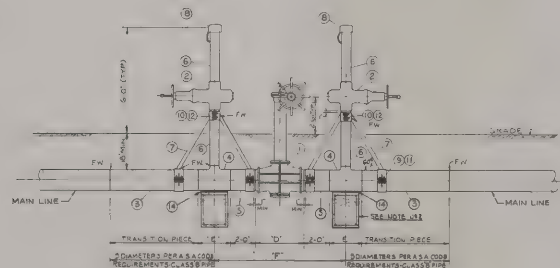
ALL REMAINING SURFACES — ALUMINUM

2 - FOUNDATIONS

THE SIZE AND LOCATION OF FOUNDATIONS FOR VALVE & BLOW OFF SUPPORT IS DEPENDENT ON LOCAL SOIL CONDITIONS. THE FIELD ENGINEER WILL FURNISH PROPER SPECIFICATIONS OF EACH AFTER EXCAVATION. FOUNDATIONS TO EXTEND BELOW FROST LINE



PLAN



ELEVATION

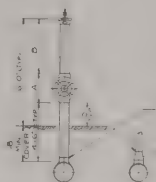


TABLE Nº 1 - MAIN LINE VALVES

VALVE SIZE	8"	10"	12"	14"
"D" DIM 400	23 1/2"	26 1/2"	30"	32 1/2"
"E" DIM.	14"	17"	20"	22"
"F" DIM	7-[illegible] 1/2"	7-7 1/2"	8-2"	8-6 1/2"

TABLE No 2 - BLOW OFF FABRICATION

ML SIZE	BO SIZE	DIMENSIONS A	DIMENSIONS B	BO VALVE
8"	4"x.237 WT	16"	3-4"	4"x2" BORE 4 026
10	4x.237 WT	6'	3-4"	4"x2 BORE 4 026
12	4x.237 WT	16"	3-4"	4"x2" BORE 4 026
14	6x.280 WT	9 1/2"	3-1/2"	6x4 BORE 6 065

MATERIAL LIST

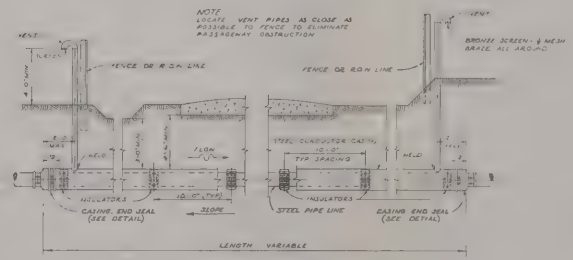
ITEM	QUANT	UNIT	DESCRIPTION
1	1	EA	VALVE, PLUG, VENTURI TYPE HIGH HEAD EXTENSION W.E. ASA 400 TABLE Nº1, BORED TO SUIT ITEM Nº 8
2	2	EA	VALVE GATE VENTURI TYPE W.E. ASA 400# BORE AS PER TAB. Nº 2
3	2	EA	TRANSITION PIECE
4	[illegible]	EA	TEE REDUCING XH ASTM A 234 52000 MY
5		FT	PIPE ASTM A 106 GR B
6		FT	PIPE, ASTM A-106 GR B
7		FT	PIPE 2.375 O.D. SCH 80 ASTM A53 SMLS
8	2	EA	CANVAS WEATHER CAP WITH 18" LENGTH LIGHT CHAIN
9	4	SET	CLAMP [illegible] PIPE
10	2	SET	CLAMP 80 PIPE
11	8	EA	BOLTS MACHINE 3/4" x 4" LONG 5/8 HEX NUT
12	8	EA	BOLTS MACHINE 3/4" x 3" LONG 5/8 HEX NUT
13	SEE NOTE	EA	REDUCER CONC 6"x4" ASTM A 234 GR B XH
14	2	EA	PAD 3/4" CREOSOTED PLYWOOD

BECHTEL CORPORATION
SAN FRANCISCO

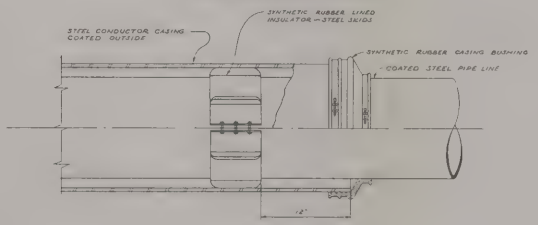
ALBERTA-CALIFORNIA PROJECT

PIPELINE BLOCK VALVES
REDUCED PORT VENTURI PLUG
A.S.A. SERIES 400W.E.-10" THRU 14"

October 8, 1957



TYPICAL CROSS SECTION



CASING SEAL DETAIL

NOTES

1. INSULATION CLAMPS SHALL BE INSTALLED AT EACH END OF CASING WITH THE OUTSIDE EDGE 12 IN FROM ENDS OF CASING. DISTANCE BETWEEN INTERMEDIATE CLAMPS SHALL BE APPROXIMATELY 10 FEET DIVIDED EQUALLY BETWEEN OUTSIDE ...

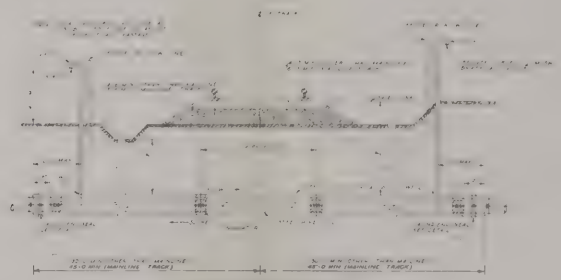
NOMINAL PIPE SIZE

PIPE	CASING	VENT	PIPE	CASING	VENT

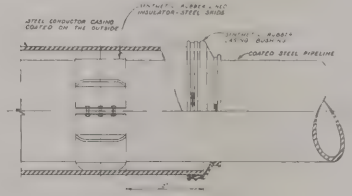
BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA – CALIFORNIA PROJECT

HIGHWAY CROSSING
OIL OR GAS TRANSMISSION LINES



TYPICAL CROSS SECTION



CASING SEAL DETAIL

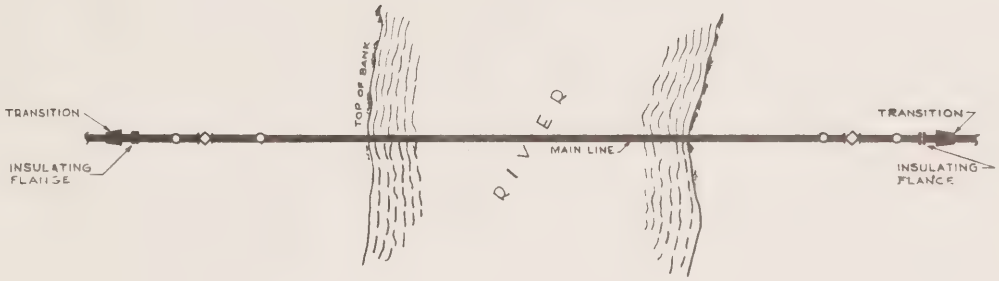
NOMINAL PIPE SIZES					
PIPE	CASING	VENT	PIPE	CASING	VENT

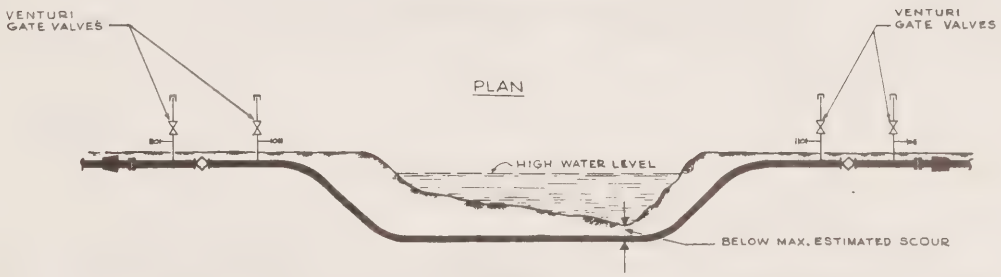
BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA – CALIFORNIA PROJECT

RAILROAD CROSSING
OIL OR GAS PIPELINES
OPERATING AT 200 P.S.I. OR HIGHER

October 8, 1957



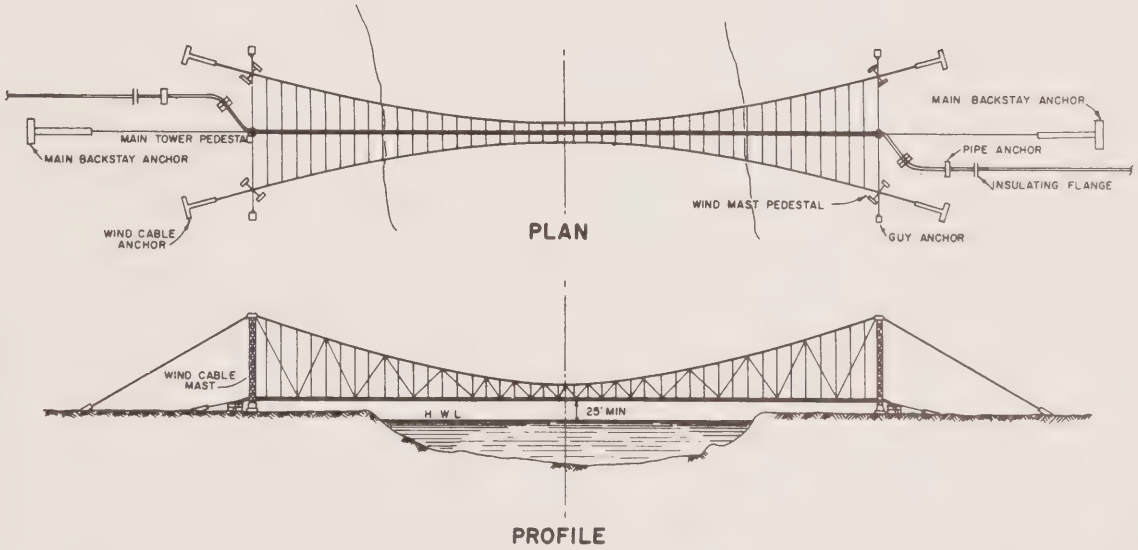


NOTES:
1. BANKS OF RIVER TO BE RESTORED TO AS NEAR ORIGINAL CONDITION AS POSSIBLE AND SHALL BE TERRACED, SODDED AND SAND-BAGGED WHERE REQUIRED BY ENGINEER.
2. PIPE TO BE DOUBLE-COATED AND DOUBLE-WRAPPED.
3. CONTINUOUS CONCRETE COATING TO BE APPLIED FROM OVERBEND TO OVERBEND TO PROVIDE 20% NEGATIVE BUOYANCY IN 72"/CU.FT. MUD.

BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA – CALIFORNIA PROJECT

TYPICAL MAJOR SUBMARINE RIVER CROSSING



BECHTEL CORPORATION
SAN FRANCISCO

ALBERTA – CALIFORNIA PROJECT

TYPICAL AERIAL CROSSING